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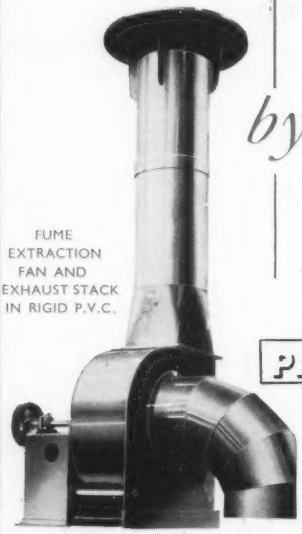

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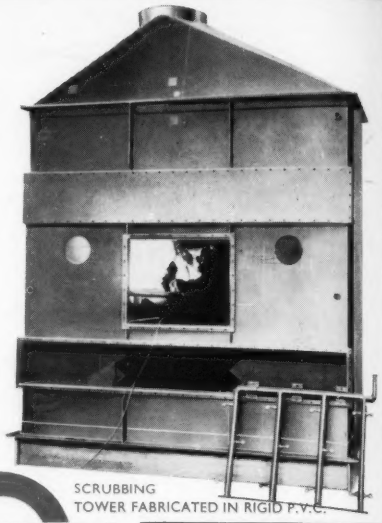

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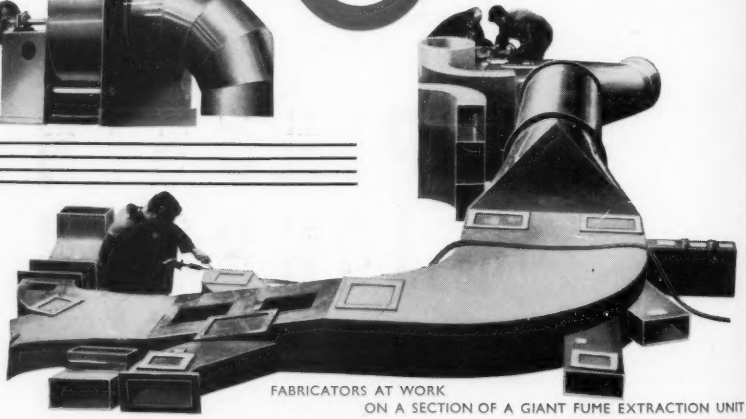

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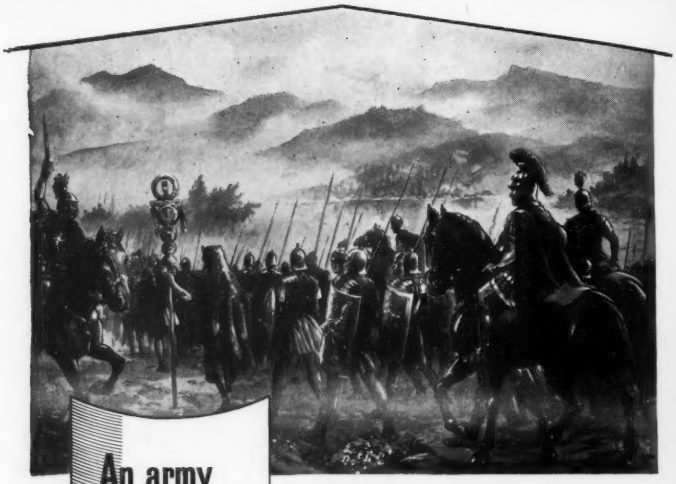

An army that disappeared

In the Spring of 217 B.C., Hannibal, the Carthaginian Commander, crossed the Alps and invaded Italy. He defeated a great Roman Army at Trebia, leaving a hard-pressed Senate to defend a threatened Rome. With considerable difficulty they raised a further 40,000 men and despatched them under the Consul Flaminius to drive off the Carthaginians. Their choice of a commander was unfortunate, for Flaminius was a hot-blooded, impetuous man of little military ability. To draw him to a battleground of his own choosing, Hannibal after burning and wasting Umbria, then retired along the narrow shore of Lake Trasimenus, dropping off picked divisions into the surrounding hills to outflank the pursuing legions and block their advance. Furious at this ravaging on Roman soil, Flaminius rushed after the Carthaginians. The Romans, in column-of-march, were soon in the trap, and Hannibal's troops, who had been concealed by the dense morning mists and high hills, rushed down and destroyed them. An army of 40,000 men who had marched off along the quiet lakeside into the mist, had *vanished without trace* ere nightfall . . . . . .

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Fig 1.

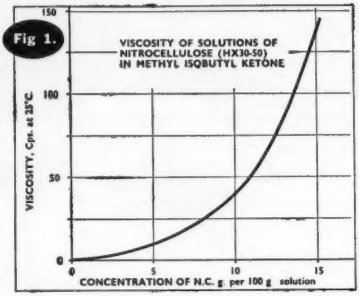

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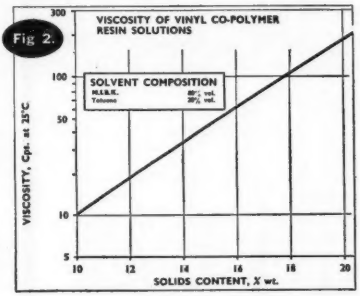
Fig 2.



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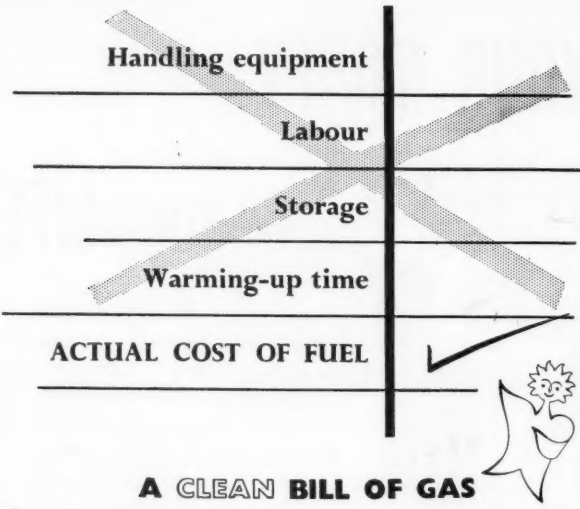

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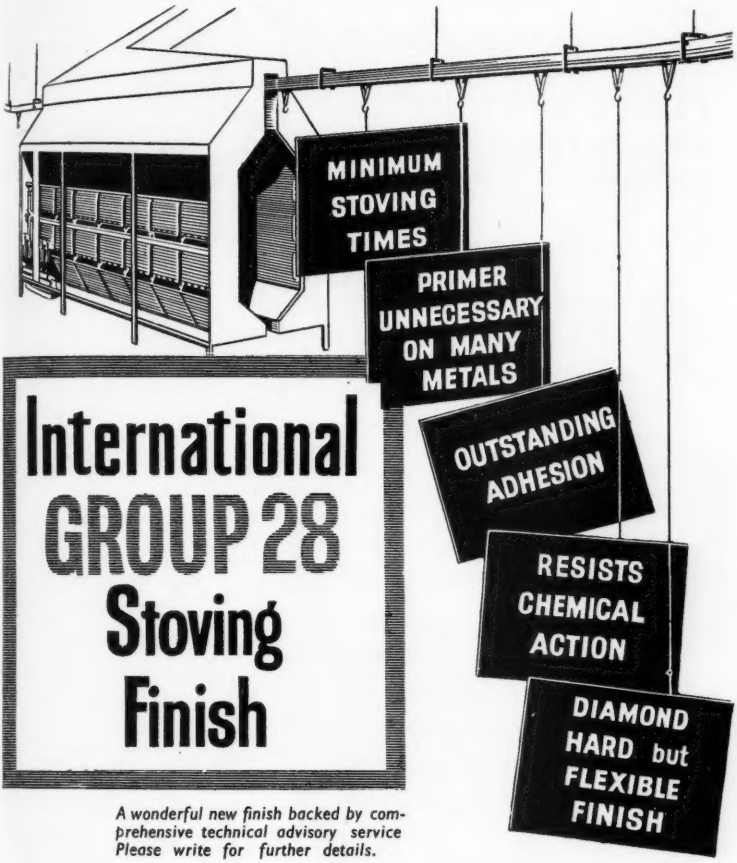

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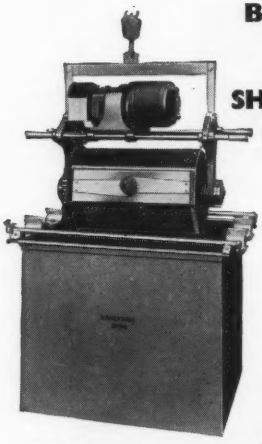
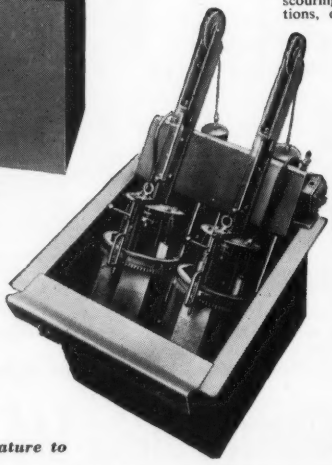


Fully Submerged Plating Barrel No. 163.



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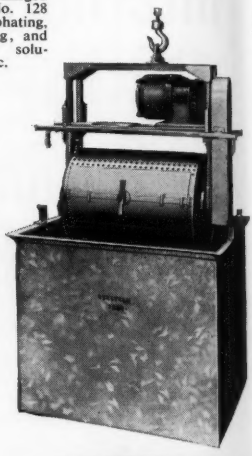

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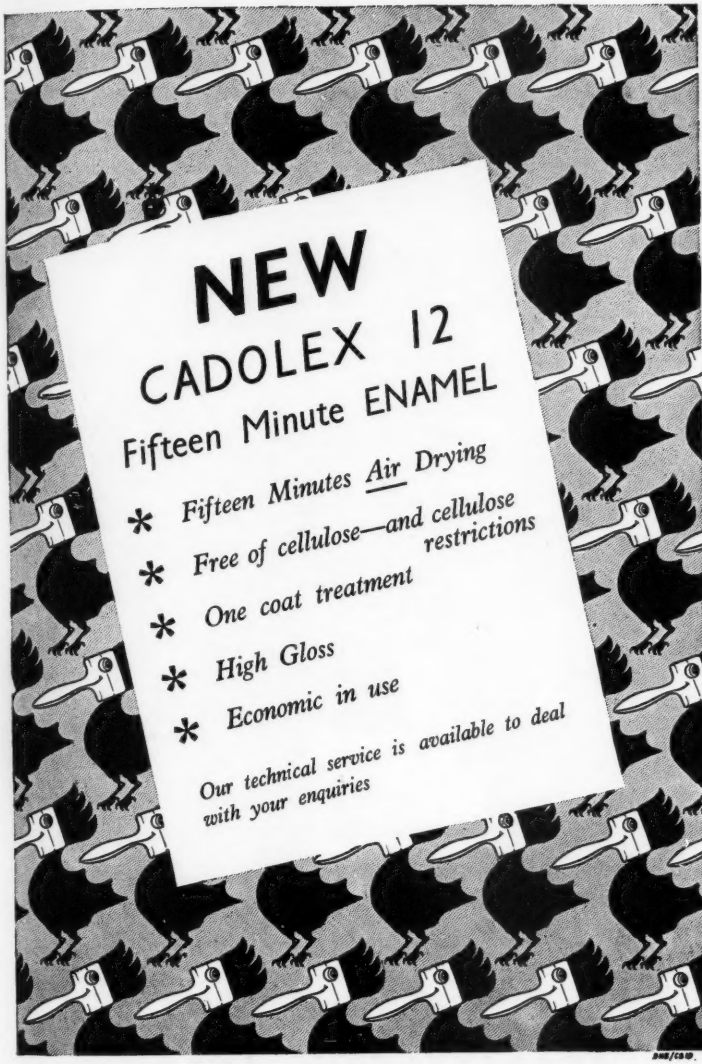
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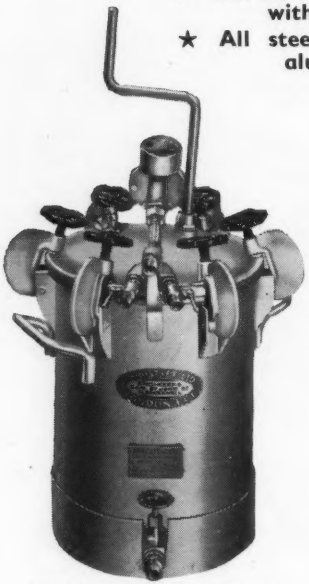

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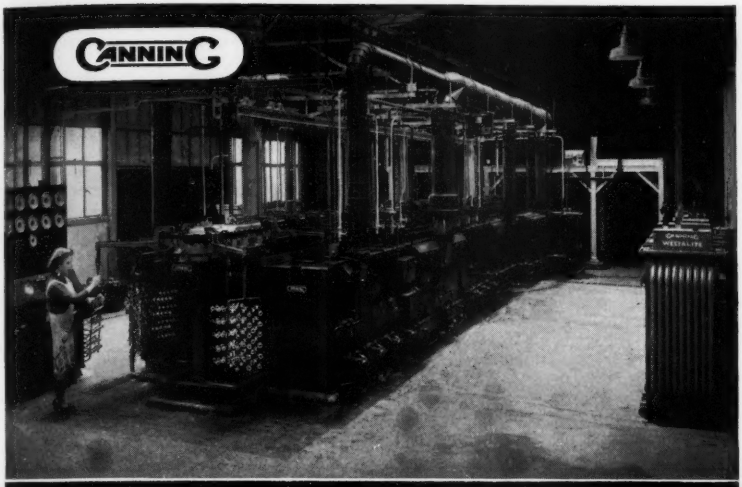

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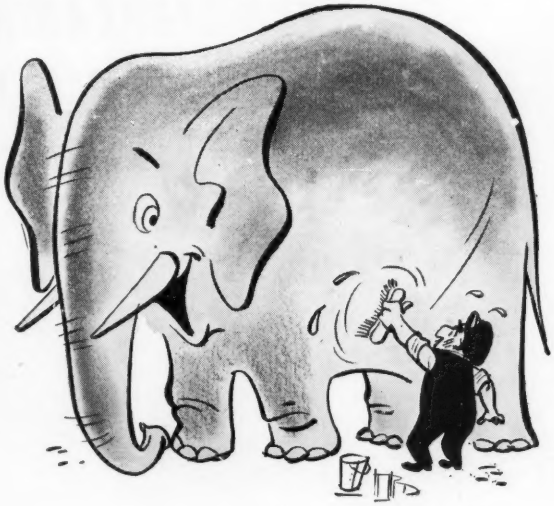
A Hard job of cleaning?



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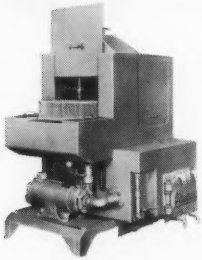
Geigy E17

Dawson Cleaning Plant

FOR DEGREASING & WASHING ALL TYPES OF METAL PARTS

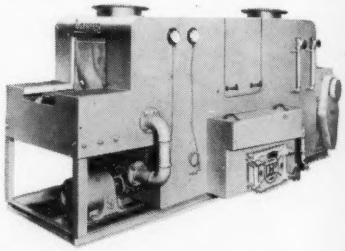


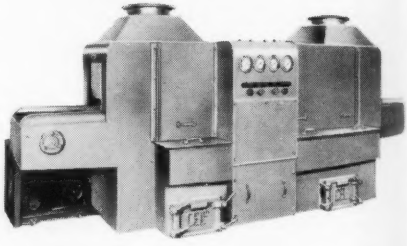
MINOR "
A non-automatic general purpose machine for washing only.

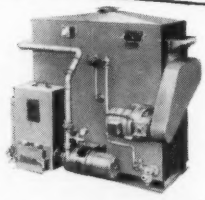
MODEL 'A'
For washing only, having continuous output of large or small parts.

MODEL 'B'
For washing and rinsing medium size castings or baskets of small parts.

MODEL '00'
Rotary Drum for washing small parts of intricate nature.







The illustrations show four of the many types of Dawson machines built for the quick economical washing, rinsing and drying of Metal Parts of all sizes.

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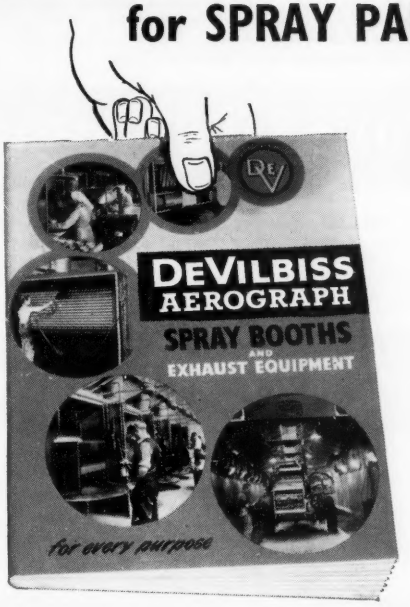

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Page

FEATURE ARTICLES

EDITORIAL 175

ELECTRODEPOSITION OF TIN ALLOYS 176

MODERN APPLICATION TECHNIQUES FOR LARGE-SCALE PAINTING 184

FINISHES AT SCOTTISH INDUSTRIES EXHIBITION ... 192

REDUCING FINISHING COSTS 200

MISCELLANEOUS

READER SERVICE CARD ... ... *facing page* 216

S.B.A.C. SHOW—FARNBOROUGH 206

RECENT DEVELOPMENTS 208

MANUFACTURE OF COLOUR PIGMENTS 212

BOOK REVIEWS 216

NAMES IN THE NEWS 218

ADVERTISERS' INDEX 226

CLASSIFIED ADVERTISEMENTS 226

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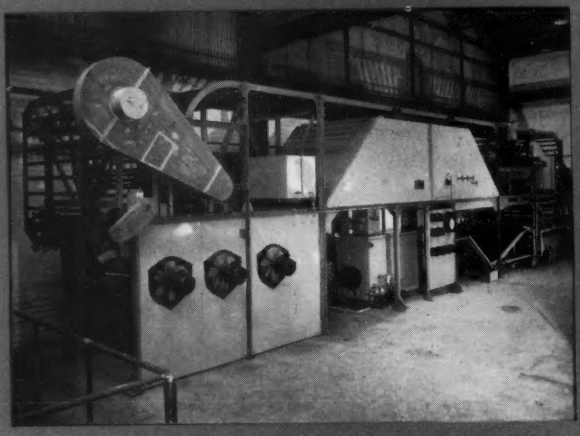

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Salesmanship and Showmanship

A FEW days ago we met Mr. Harry W. Howard. He was visiting from the United States as one of the Shell specialists in industrial surface coatings, with a particular interest in "Epikote" resins. He has graduated in chemical engineering from an American University and has been in the lacquer business for some twenty years or more.

Apparently when Shell were trying to market these new resins in the United States they ran up against a formidable problem of trying to introduce what appeared at first sight to be an excellent product to the somewhat sceptical surface coating manufacturers. Orthodox approaches brought little result, but Mr. Harry W. Howard had a new idea.

He recalled the travelling huckster who sold pills and nostrums of various types from town to town with a great deal of spectacular showmanship, whilst his product had somewhat nebulous characteristics. He rightly thought—if the huckster can do this with coloured water, why can't we do it with a first rate product?

And so it is that he developed a huckster type of act which was entertaining and had that ring of truth which he has used effectively in the States towards buyers and users of surface coatings. He has before him his samples—he has articles coated with coatings made from phenolics, ureas and Epikote. He has a series of spectacular tests to show the effectiveness of Epikote coatings.

One is not prepared to admit that he avoids entirely the conjuror's wiles, but over-all he presents a technical story which any technician would find it difficult to disprove. What is more, he presents it over a period of an hour with the style of a polished publicist, and yet when it comes to question he reverts to the technician and is able to parley with his technical critic's point for point.

We mention Mr. Howard here because he introduces a new approach to selling a mundane product like a resin—in fact, his talk, made into a film and taken round and about, would be humorous enough to go on a circuit for entertainment value in its own right.

For three years he has been addressing the paint production clubs in America and Canada. He is now visiting Europe and England. Appropriately he is a member of an American Society called the Gallow Birds—founded as a tribute to those who "stick their necks out to write government specifications," and he wishes to introduce a branch of this Society in the United Kingdom.

But over-all it is a new approach to selling and from the excellent results achieved in the States it is successful and is being copied by his competitors. The show he put over last week had its script to a large extent Anglo-Saxonised —but given free scope in his own country his show must be a "wow"! But, of course, this huckster is selling a product where the laboratory reports and technicians' comment are very favourable.

EXCLUSIVE

Electrodeposition of Tin Alloys

by

J. W. CUTHBERTSON, D.Sc., F.I.M., A.M.I.E.E.*

ALLOY-plating is still in its early stages of development. Brass has been electrodeposited for many years and a few other alloy deposits, bronze and nickel-cobalt for instance, have more recently attained industrial importance. The success that has been achieved in alloy-plating has been, and to a large extent still is, the result of painstaking empirical experimentation and is in little part due to theoretical reasoning. The theory underlying the simultaneous deposition of two metals is not yet elucidated and although some progress has been made much research must still be done before we can hope to predict with any certainty the conditions under which co-deposition is likely to be possible. Generalisations can be made from existing knowledge of the deposition potentials of single metals, but, as two metals in a common electrolyte do not necessarily behave as might be predicted from their individual electrochemical properties, such assumptions must be cautiously applied. In the circumstances research on alloy-plating remains largely empirical, and processes must still be worked out mainly by trial and error.

In recent years considerable progress has been made in the co-deposition of tin with other metals. Prior to the nineteen-thirties tin-lead and bronze were the only tin alloys deposited on a commercial scale. Since then, processes have been devised and developed industrially for the deposition of speculum (tin-copper), tin-zinc, and tin-nickel. More recently, techniques have been worked out for the deposition of tin-antimony and tin-cadmium alloys.

*Formerly Assistant Director of Research, Tin Research Institute; Professor of Metallurgy at University of Nottingham.

Reasons for Alloying Other Metals With Tin

Pure tin is very resistant to corrosion and is non-toxic. The pure metal is thus attractive for protecting more corrodible metals and for use in contact with foodstuffs. Unfortunately, electrodeposits of commercial thickness are almost invariably porous, and it is not economically practicable in the case of a relatively expensive metal to increase the thickness of the deposit to the point where porosity disappears. Complete elimination of porosity may call for a very great increase in thickness. Tin is cathodic to steel, and under ordinary atmospheric conditions any porosity in the tin leads to the formation of rust spots. The thicker the tin coating, the less rapidly does rusting occur, but tin coatings of usual thickness cannot be expected to afford long-term protection to steel in a corrosive environment (to avoid misinterpretation of this statement it should be explained that, for reasons which need not be gone into here, the tin coating inside a sealed tin can is *anodic* to the steel, and it thus affords sacrificial protection at exposed pores).

As it seems that some porosity must be tolerated the only method of reducing or preventing the development of rust is by altering the electrochemical properties of the protective coating. Alloying suggests an immediate means of doing this; the extent to which the desired results can in this way be achieved is discussed below.

Alloying tends to reduce the crystal grain size of electrodeposited tin, and as porosity usually decreases as grain size diminishes the addition of a second metal can be beneficial from this further viewpoint. Tin is a soft metal, and in applications where rough

usage may arise alloying is advantageous because suitable alloy additions harden tin.

A further purpose of alloying is to provide a coating of inherently greater tarnish resistance than pure tin. While tin itself, as already mentioned, resists corrosion it nevertheless tarnishes in the atmosphere, and for decorative purposes its lustre is not sufficiently permanent.

Types of Possible Alloy Coatings

Three types of true alloy are recognised by the metallurgist: (a) solid solutions; (b) eutectics; (c) intermetallic compounds. Only a few metals form extensive solid solutions with tin; of the alloys that have been electrodeposited tin-antimony and possibly tin-zinc are the only ones exhibiting appreciable solid solubility of the second metal. The main effect of such solubility is an increase in the hardness of the tin matrix. Cadmium, lead, and zinc respectively form eutectics with tin. In such alloys the electrochemical properties are largely determined by the more reactive, i.e., the more negative metal. The equilibrium potential of the alloy tends towards that of the more negative metal, and over a fair concentration range of that metal is substantially constant. Of the three metals mentioned cadmium and zinc are more negative while lead is slightly less negative than tin. In the former cases the potentials of the alloys would thus be expected to approach those of the alloying metals whereas in the case of lead the potential would be near that of tin. This reasoning is not strictly correct because some solid solubility is also present, but the equilibrium potential values in practice are not far removed from the predicted values. The eutectic type of alloy is the one in which the properties and behaviour of the alloy can be predicted with most certainty from a knowledge of the properties of the constituent metals.

Tin readily forms compounds with other metals and while such compounds are almost invariably harder than their constituents, their corrosion-resisting properties cannot be predicted. Reduced, or possibly greatly enhanced, resistance to corrosion may result from intermetallic compound formation. Tin-copper in the speculum range, tin-nickel, and tin-cobalt as electrodeposited are all intermetallic compounds, and each is characterised by a resistance to tarnishing far exceeding that of its constituents. Intermetallic compounds thus afford most interesting possibilities from the viewpoint of finding new decorative finishes.

Practical Alloy-plating

In the space available it is clearly impossible to deal with all of the aforementioned tin alloys. Moreover, the deposition of tin-lead and tin-copper alloys, the oldest of the series, has already been discussed in detail elsewhere. The writer proposes, therefore, to restrict this article to the two alloys tin-zinc and tin-nickel which typify the eutectic and the compound type of alloy respectively, and which have attracted considerable interest since they were first introduced to industry.

Tin-zinc. Tin-zinc alloys containing approximately 25 per cent. of zinc have been deposited commercially for some eight years and this protective coating is steadily growing in popularity. Tin-zinc alloy plate in the composition range 20-30 per cent. zinc is characterised by excellent resistance to corrosion and good solderability. The biggest use of the coating is as a replacement for electrodeposited cadmium.

TABLE 1.

Tin (added as sodium stannate)	30 grm. per 1·
Zinc (added as zinc cyanide)	2·5 grm. per 1·
Total cyanide (expressed as sodium cyanide)	28 grm. per 1·
Free sodium hydroxide	4-6 grm. per 1·
Working temperature	65° ± 2°C.
Cathode current density	10-30 amp. per sq. ft.
Anode current density	7-15 amp. per sq. ft.
Working voltage	3·5-4·5 volts

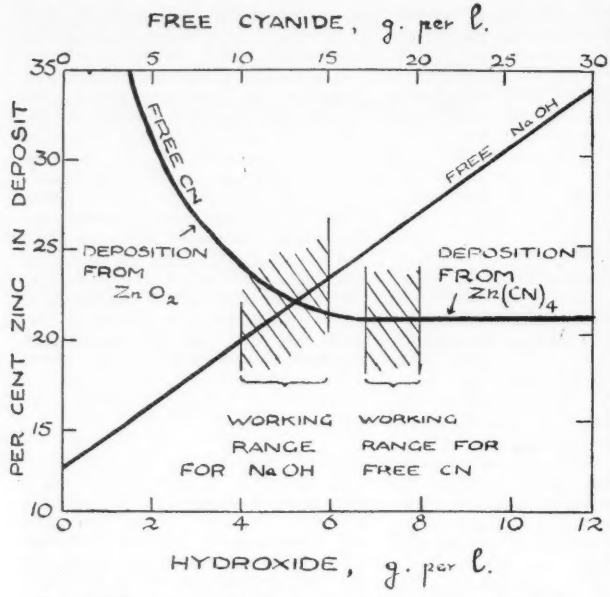


Fig. 1. *Effect of variation in the cyanide and hydroxide content of the electrolyte on the composition of tin-nickel alloy plate*

The composition of the electrolyte and working conditions are given in Table I[1].

As the electrolyte contains both hydroxyl ions and cyanide there is the possibility of both zincicyanide ions, $Zn(CN)_4^{--}$, and zincate ions, ZnO_2^{--}, being present. If sufficient cyanide is present the zincate ion concentration is low, and the latter ions play no significant part in the cathode process. Below about 15 grm. per litre of free cyanide the zincate ions take an increasing part in the deposition process and as a consequence the zinc content of the deposit rises rapidly. This effect of variation in free cyanide concentration is shown in Fig. 1; in practice, the free cyanide is not allowed to fall below 15 grm. per litre, and variation in cyanide concentration above that figure does not affect plate composition. Variation in the hydroxide concentration of the electrolyte is accompanied by a linearly proportional change in deposit composition (Fig. 1). Control of the deposit composition is conveniently effected by altering the hydroxide concentration.

A view of a typical semi-automatic tin-zinc plating plant is shown in Fig. 2. The plating tank is fabricated from steel and need not be lined as the electrolyte is non-corrosive. The use of an unlined tank can only be criticised on the grounds of possible bi-polar action, but this can be obviated by providing loose glass linings on the sides, which is cheaper than the more elegant remedy of lining the tank with rubber. Heating is usually effected by steam coils of steel tubing.

Soluble alloy anodes (25 per cent. zinc) are used with this process. The anodes are operated in the filmed condition, exactly as in stannate tin-plating practice. For special purposes insoluble anodes can be used, and the electrolyte regenerated by adding salts; an objection to this procedure is the accompanying steady increase in the hydroxide concentration and insoluble anodes are, therefore, best avoided unless the shape of an article makes their use indispensable.

Properties and Uses of Tin-zinc

Tin and zinc form a eutectic series of alloys. The electric structure is not readily discernible in the electro-

[1] *In the United States a modified electrolyte, in which the corresponding potassium salts are substituted for sodium stannate, sodium cyanide, and sodium hydroxide, is very popular. As in stannate tin-plating, the use of potassium salts is claimed to permit higher cathode current densities to be employed.*

Fig. 2. General view of a 1,300 gal. semi-automatic tin-zinc plating bath

deposited alloy, but the plate, nevertheless, contains both free tin and free zinc. The equilibrium potential of tin-zinc is very close to that of zinc and the plate affords sacrificial protection to steel to which it is anodic. Compared with zinc, however, the rate of attack of the coating itself seems to be very much lower and there is no rapid formation of the "white rust" which is so typical of empassivated zinc on steel. Tin-zinc, in fact, combines the advantages of tin and zinc—inherent resistance to corrosion of the coating on the one hand and sacrificial protection at pores on the other—while greatly reducing the disadvantages of porosity in the case of tin and of rapid attack of the coating and consequent formation of white rust in the case of zinc. Compared with electrodeposited tin of similar thickness, tin-zinc is less porous, and this is a further point in its favour. Good protection is afforded over a fairly wide composition range and there is thus no necessity to control the amount of zinc in the deposit closely.

As a protection for steel tin-zinc is superior to cadmium except possibly under severe marine conditions. Compared with zinc, it retains a good appearance for a longer time, but under outdoor conditions rusting ultimately is likely to occur sooner than with zinc as only one-quarter of the weight of the coating is available for sacrificial protection. Tin-zinc is not, therefore, recommended as a substitute for galvanizing of fencing wire or other products that are expected to have a long outdoor life. Under marine conditions, however, tin-zinc is superior to zinc.

Tin-zinc is as easy to solder as tin, and its solderability is not impaired by passivation (referred to below) nor does it deteriorate on prolonged storage. Paint adheres extremely well to tin-zinc, and in this respect also the alloy deposit is superior to cadmium.

The customary thickness of tin-zinc is 0·0005 in. If the deposit is passivated, which can be done by simple immersion in a 2 per cent. solution of chromic acid or in an acid bichromate solution, the thickness can be reduced to 0·0003 in. Passivation is not normally necessary for deposits of thickness 0·0005 in. or over, but is often favoured as it tends to reduce finger-marking.

As deposited, tin-zinc has a matt, white appearance. The plate can be polished or scratch-brushed to give a decorative appearance. It cannot be bright dipped nor can it be deposited bright from the existing electrolyte. Work is in hand on an alternative acid electrolyte that produces bright deposits and shows some levelling action, but this new process has not yet passed beyond the laboratory stage.

Uses

Tin-zinc is widely used for plating radio, radar, and other electrical equipment, where its ease of soldering is a particular advantage. It is also used for plating motor-cycle parts, hub spindles, petrol pipes and tanks, etc., for typewriter components, for motor-car brake parts, and for aeroplane undercarriages. There are many other existing and possible new uses too numerous to mention. One of the latest possible applications of the coating is for the protection of steel nuts and bolts used in the assembly of aluminium structures. The attraction of tin-zinc for this purpose lies in its apparent equi-potentiality with

TABLE 2.

Stannous chloride	50 grm. per 1·
Nickel chloride	240 grm. per 1·
Sodium fluoride	38 grm. per 1·
Ammonium bifluoride	17·5 grm. per 1·
Working temperature	65°-70° C.
Cathode current density	15-25 amp. per sq. ft.
Anode current densities	
Tin	not less than 50 amp. per sq. ft.
Nickel	10-50 amp. per sq. ft.
Working voltage	2·0-3·5 volts
*p*H	about 2·5

aluminium, and it thus protects the bolts without stimulating attack of the neighbouring aluminium.

Tin-zinc has good anti-frictional properties, and might, therefore, be a useful overlay finish for bearings, or even be suitable for making bearings by direct electrodeposition on steel. Its possibilities in this direction are under investigation.

Economics of Tin-Zinc-plating as compared with Cadmium-plating

It is diffiult to draw an accurate comparison between the cost of one plating process and another, especially when a single metal, on the one hand, and an alloy on the other, are involved. The following comments, however, may be of general interest.

Labour costs for tin-zinc and cadmium-plating are approximately the same. Tin-zinc calls for slightly more laboratory control, and once or twice a year demands additional labour for a short time for the removal of excess carbonate from the bath. Also, the cost of heating the electrolyte must be taken into consideration. Chemical replacement costs for tin-zinc-plating are greater than for cadmium-plating as there is a continuous loss of cyanide from the tin-zinc solution and some loss of tin through occasional slight fall in anode efficiency. These extra costs for the tin-zinc process are more than compensated by the higher cost of cadmium anodes as compared with tin-zinc anodes. At the time of writing, the cost of tin-zinc anodes per pound is approximately half the cost of cadmium anodes. When the additional costs for labour, heating, and chemicals are taken into account the overall cost of tin-zinc-plating works out to about 60 per cent. of the cost of cadmium-plating for the same thickness. This estimate is for large plant (say 1,000 gal.) operating at maximum efficiency. For small plants operated intermittently the balance is slightly less in favour of tin-zinc although it still has a big margin of economy.

Tin-nickel. Tin-nickel-plating is a new and unique process for providing a tarnish-resisting decorative finish. The process was discovered in the course of investigating the possibility of hardening electrodeposited tin by adding nickel to it. The particular alloy that constitutes the tin-nickel deposit now being developed commercially contains tin and nickel in equi-atomic proportions and is an intermetallic compound of formula NiSn.[2] Prior to this work the existence of this compound was not known, nor is it possible at present to make it by any means other than by electrodeposition. It would have been quite impossible to predict the existence of this compound from present metallurgical knowledge and its discovery should be an encouragement to those engaged on research of an empirical nature.

Tin and nickel are too far apart in the electrochemical series to permit ready deposition from mixed salt electrolytes. A complex electrolyte is necessary, and the most suitable complexing medium so far found is the fluoride ion. The composition and working conditions for the tin-nickel electrolyte are given in Table 2.

The above make-up gives a solution that has a total fluorine content of 29 grm. per 1· and a free hydrofluoric acid content of 6 grm. per 1·.

The electrolyte is contained in a steel tank lined with suitable rubber. Very little fume is evolved from the bath, but owing to the toxicity of

[2] *This composition corresponds closely to 65 per cent. tin—35 per cent. nickel.*

fluorides fume extraction must be provided. The electrolyte should be filtered continuously, preferably through paper. At all times it is essential that the electrolyte be kept scrupulously clean.

Separate tin and nickel anodes, preferably on separate circuits, were exclusively used in the early days of this process but excellent results are now being obtained with cast tin-nickel alloy anodes containing around 30 per cent. of nickel. The anodes should be of the highest purity commercially available; in particular, the tin should have the lowest possible lead content (lead is not a likely impurity in nickel). The anodes should be bagged. "Terylene" cloth is very suitable for the purpose. The nickel anodes should be left permanently in the bath but if the solution is likely to be idle for some days the tin anodes should be withdrawn.

For further details of the technology of this process the reader is referred to the literature given in the references.

Properties of Tin-Nickel

The outstanding property of tin-nickel is its extraordinary resistance to atmospheric tarnishing. The deposit is fully as tarnish-resisting as chromium and compared with that metal has a warmer colour which makes it very attractive for finishing articles, particularly of the domestic type, that the cold, blue colour of chromium does not suit. Tin-nickel is characterised by a faint pink tint and complete absence of any blueness.

Tin-nickel is almost completely immune to attack by condiments, including common salt. It is not attacked by dilute mineral acids; it is attacked by concentrated hydrochloric and sulphuric acids but only very slightly by concentrated nitric acid.

Being an intermetallic compound, tin-nickel is hard (about 650 Vickers) and somewhat brittle, but the brittleness is not sufficiently great to detract from its serviceability. It is not possible, however, to fabricate work after tin-nickel-plating. The compound corresponding to the electrodeposit is not found in the thermal equilibrium diagram for tin and nickel, for the reason that it is metastable. Tin-nickel is perfectly stable at temperatures up to about 300° C., but at and above that temperature it recrystallises and reverts to the equilibrium mixture of Ni_3Sn_2 and Ni_3Sn_4. Recrystallisation is accompanied by a volume change which leads to disintegration, and the alloy plate is thus not suitable for use above 300° C.

The customary thickness for tin-nickel is 0·0005 in. The plate can be deposited direct on steel and on copper-base alloys. Zinc-base alloys and aluminium are attacked by the tin-nickel electrolyte but can be plated if first given a good undercoat of copper or, in the case of zinc alloys, red bronze. Tin-nickel is electrochemically considerably more noble than steel but somewhat less noble than copper. To avoid any chance of corrosion at pores the use of a copper undercoat when depositing the alloy on ferrous metals is strongly recommended.

When deposited on a bright base, tin-nickel itself is almost bright. Some slight finishing may be necessary, but only the very minimum is required.

Advantages of Tin-Nickel

Apart from the advantages already mentioned, the fact that tin-nickel-plating is a single process as compared with nickel-chromium-plating is much in its favour. Also, nickel is a strategic metal and as such any attempt to conserve it should be welcome. The fact that tin-nickel affords a saving in nickel of about 65 per cent. as compared with nickel-chromium is an important consideration. A feature of the tin-nickel-plating process is that the composition of the deposit remains very constant irrespective of quite wide changes in the metal content of the electrolyte. Control of deposit composition thus scarcely arises, and the process becomes almost as simple as the deposition of a single metal. The thickness of tin-nickel deposits varies less with the shape of the article than is the case for most plating processes; the throwing power of the tin-nickel electrolyte is, in fact, so high that the use of internal anodes is hardly ever necessary.

Uses of Tin-Nickel

Tin-nickel can be used for finishing many articles at present plated with nickel-chromium. Its field of application is very wide and is only just

beginning to be explored. At the present time it is being used for finishing table lamps, for plating the steel cases of small primary cells, for providing a permanent and protective finish on chemical weights, to mention established applications. It has been tried out for many other purposes with most satisfactory results, and a big expansion of its use is envisaged.

Tin-Nickel-plating in Practice.

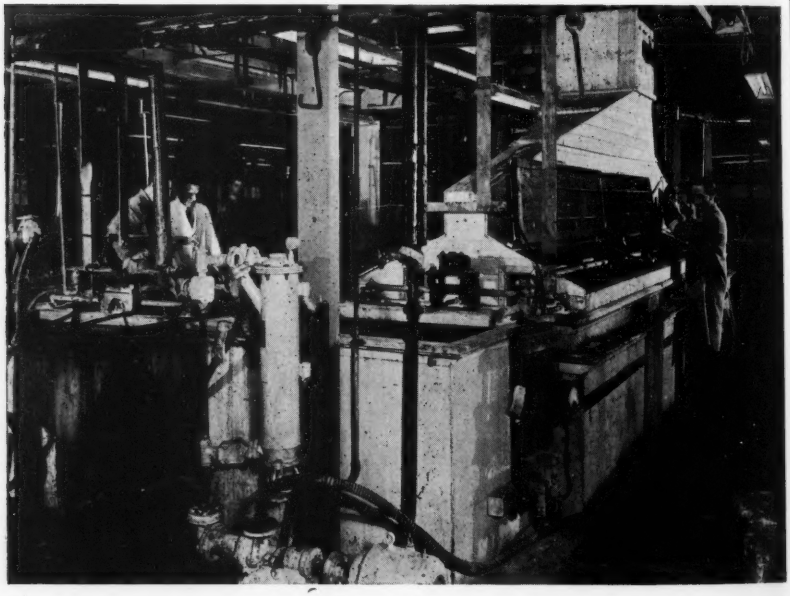
The tin-nickel-plating process has been in commercial operation for several years during which time much valuable experience has been gained. The causes of pitting, which was troublesome in the early days, have been diagnosed and although the complete theory of the process has not been elucidated sufficient is now known to enable any trouble that may arise in practice quickly to be overcome. The plant shown in Fig. 3 has been in daily operation for some two years and the minimum of trouble has been experienced. Provided the instructions laid down are properly followed this process can safely be claimed to be as easy to operate as any bright-plating process.

No special precautions have to be observed in preparing work for tin-nickel-plating; the usual cleaning procedures are adequate. As the plate has no levelling action it is only bright if the basis metal is bright; it is much easier to polish the basis metal beforehand and lightly mop the tin-nickel where necessary rather than to deposit dull tin-nickel and finish.

Rejects, are few, and some salvaging can be done as it is easy to plate tin-nickel on itself. This is fortunate because the refractory nature of the deposit makes stripping difficult, especially when the basis metal is steel.

Better understanding has greatly simplified the control of this process, and if a few simple precautions are taken trouble need not arise. In the first place the electrolyte must be kept free from contamination by foreign metals and by organic matter. Lead, and to a somewhat lesser extent, copper are the two most objectionable metallic impurities. Organic matter causes pitting, and for this reason filtration through carbon should be

Fig. 3. View of large tin-nickel plating plant



avoided unless it is absolutely necessary. If carbon must be used, further filtering through paper is essential to remove all traces of carbon from the electrolyte.

The heating of the electrolyte should be arranged in such a way that temperature stratification does not occur. A cold layer on the top of the bath produces dull plate. Agitation by cathode movement assisted by circulation through the filtering pump helps to overcome any temperature variation throughout the bath.

The metal content of the electrolyte does not alter much as the anode and cathode efficiencies both approach 100 per cent. However, there is some slight loss of tin through oxidation and at intervals additions of stannous chloride may have to be made. Successful operation is contingent on maintaining the stannous tin and fluoride contents of the electrolyte at or just above the recommended concentrations. This is so important that some explanation of the theory on which the control of these constituents is based is desirable. Satisfactory tin-nickel deposits are only obtained so long as the stannous tin content of the bath is above a certain minimum. The figure given in Table 2 is well above this minimum. When the electrolyte is hot, stannous tin is slowly oxidised, and after a time there will be an appreciable concentration of stannic tin in the bath. The stannic tin can be regarded as inert; it takes no part in the deposition at the cathode. Its practical significance is in the loss of stannous tin which it causes and in its own demands for fluoride. Fluoride content is fully as important as stannous tin content. Deficiency in fluoride leads to very poor deposits. The minimum safe fluoride content is determined by the amounts of stannous tin and stannic tin present. Four fluorine atoms must be provided for every stannous tin atom, and six fluorine atoms for every stannic tin atom, in order to form the complexes that are an essential feature of the process. These requirements are summarised in the equation:

$$\text{Minimum } F = (4x \times Sn^{II}) + (6x \times Sn^{IV})$$

where $x = \frac{\text{at. wt. of Sn}}{\text{at. wt. of F}} = \frac{119}{118} = \frac{1}{6}$ approx.

all concentrations being in grm. per 1·.

Inserting the value for x gives:

$$\text{Minimum } F = 2/3\ Sn^{II} + Sn^{IV}$$

Methods for analysing the bath are described in the working instructions (see references), and the minimum safe fluoride content can easily be calculated once the stannous and stannic tin concentrations have been determined. As there is no objection to excess fluoride an adequate reserve can be kept in the electrolyte and it is not necessary then to make such frequent determinations of tin content. Rectification when necessary is effected by adding sodium fluoride and ammonium bifluoride, the aim being to keep the total fluorine in the range 28-38 grm. per 1·. In the hands of an experienced operator the Hull cell provides useful additional information on the condition of the electrolyte.

Although simple flat articles can be plated bright, tin–nickel is not a true bright–plating process as dull spots usually occur on complicated work. A brightener is needed, but no safe brightener has yet been found. Most organic additions suppress the deposition of the nickel unless used in such small amounts that their recommendation would be impracticable. Research on addition agents for tin and tin-alloy-plating is being assiduously pursued, and it is hoped that a suitable brightener for tin-nickel-plating may eventually be discovered.

The development of the tin-nickel-plating process marks a big advance in alloy-plating. Not only has the process provided a valuable new finish but its exploration has added considerably to our knowledge of the theory of alloy-plating. Fluoride-containing electrolytes possess certain outstanding advantages where the deposition of tin alloys is concerned, and it is noteworthy that, arising out of the work on tin-nickel, this type of electrolyte with appropriate substitution for the nickel chloride, has been successfully used for the deposition of tin-cobalt and tin-antimony alloys.

ACKNOWLEDGMENT

The tin-zinc and tin-nickel alloy-plating processes were developed in the laboratories of the Tin Research Institute. The author is indebted to the International Tin Research Council for permission to publish this report.

(*Continued on page* 191)

Modern Application Techniques for Large Scale Painting

by

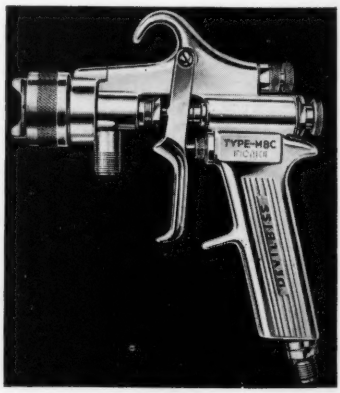
A. A. B. HARVEY, M.Sc., A.R.I.C., M.Inst.W.*

IN order to be a best seller in any competitive market a product must perform well and have a pleasing appearance which it will preserve to the end of a long life. Most goods offered for sale owe both their long life and their beauty of appearance to paint, or as it is called to distinguish it from vitreous enamel or electro-deposited metal, an organic finish.

Growth of Industrial Organic Finishing

Organic finishing on the industrial scale as we know it today is almost entirely a product of the forty years which have elapsed since the outbreak of World War I. Although painting was carried out in many factories before that time the speed and methods of production were not comparable with the mechanised stream lined processes which are characteristic of modern engineering industry. Progress in the formulation of specialised finishes for particular duties and in the devising of tools and techniques of application suitable for use in mass production factories had as yet made little or no impact on industry. Methods and materials alike would have been perfectly familiar to craftsmen of any period since the reign of Queen Elizabeth I. What would such a craftsman have seen had he been able to visit a motor-car finishing shop in the first decades of this century? The most noticeable thing would have been that a weeks or more production was locked up in the finishing shop in various stages of preparation. Each coat of primer, filler ("rough stuff") and colour varnish would be applied by hand and left to dry for anything up to 24 hours, after this it would be laboriously hand flatted and the next coat applied. Two or more coats of colour varnish were usual and each was rubbed with pumice carried on a felt pad filled with rottenstone. Repairs and the elimination of sags and runs were carried out by an expert hand employing a carefully shaped cuttle bone to level the paint down to the contour of the panel. Although it was no longer usual to buy dry colour and media and grind the ingredients together on the premises, every workman had his pet dope to add to the paint and was full of wise saws and modern superstitions—an attitude that is regrettably slow in passing. The time taken in completing the finishing was governed in part by the long drying time of

Fig. 1. Typical high production spray gun for hand application
(By courtesy of De Vilbiss Co.)



* *Chief chemist to Briggs Motor Bodies Ltd.*

Fig. 2. Spray gun fitted with extension nozzle for interior of cylinders
(By courtesy of Aerograph Co. Ltd.)

the materials then available and in part by the need, imposed by poor build, to apply multiple coats by the slow method of brushing by hand. A revealing glimpse of the atmosphere in such a finishing shop is given by O'Reilly (Trans. Inst. of Metal Finishing, 1945) when he says: "If a fly entered the finishing room all work stopped until it was caught."

Early attempts to mechanise and speed up the actual application of paint were flow coating with paint delivered from fish tail nozzles fed from reservoirs of warm paint on either side of the line, and a brush which was fed with paint under pressure to ensure a uniform supply of material and avoid loss of time in dipping the brush into the colour varnish and removing the excess on the edge of the container. The flow coating method was limited to those parts which would drain naturally without sags or runs.

The advent of the spray gun and of the rapid drying cellulose finishes within a few years of each other effected a revolution in organic finishing methods by reducing time schedules from days to hours. The revolution was more far reaching than is apparent at first sight. At this period the engineering side of mass production was already based on sound reasoning backed by practical knowledge gained largely on the floors of Detroit where the American motor industry was ushering in the gasoline age. If the motor-car and the refrigerator were to be within the means of the small professional man and the skilled artisan prices must be low, but prices can only be reduced if the volume of production allows the cost of the elaborate tools and jigs necessary for precision assembly to be amortised by a very small charge on each article. Here then was the dilemma; how was it possible to attain a high and cheap production if valuable floor space and capital must be tied up in a weeks accumulation in the finishing shop? In the case of motor-car production the demands on floor space for quite small production by modern standards were fantastic. An average motor-car of the period occupied a working space of roughly 100 sq. ft. of floor area. If the production rate were only 100 a day over a five day week then the cars in the course of finishing would occupy no less than 50,000 sq. ft. that is a shop some 70-75 yards square. The overheads represented by this floor space ate into the money that was available for research and so progress was delayed. The advent of quicker finishing methods and materials enabled industry to break its bonds and go forward in the knowledge that all its processes were now capable of mechanisation.

The saving of labour and time effected by the spray gun was more than sufficient to offset the waste of material which it caused. With brush application over 90 per cent. of the paint employed went on the job; with the spray gun more than 30 per cent. might go up the stack and have to be scrubbed out of the air lest it contaminate the neighbourhood for a considerable area round the point of emission. The spray gun also brought with it the need for supplies of clean, oil-free, dry air compressed to 80 to 90 lb. per sq. in. Despite the need for expensive spray booths, air cleaners and air compressors the spray gun remained for thirty years the unchallenged monarch of the paint shop and its reign is not yet over although other devices for paint application are beginning to appear in active industrial use. By spray gun in this context is meant the familiar spraying equipment, whether hand or automatically operated, in which a supply of liquid paint is atomised into a cloud of fine droplets by a compressed air blast. It has proved itself a most versatile tool and may be found in the studio of the artist as well as in the paint shop; it can spray paint of all types, powders, flock, or even molten metals as heavy as lead.

Some of the protean developments of the gun are shown in the illustrations figs. 1 and 2.

Automatic Spraying

The application of paint by manual spraying is an operation requiring more skill than is generally recognised since some sort of passable result may be obtained after a very short period of training, but for first class work the employment of skilled and versatile men is required. A good finishing material may easily be condemned in production because spray men find it difficult to adapt themselves readily to variation in spraying methods. For this reason as well as

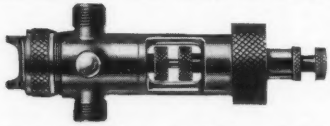
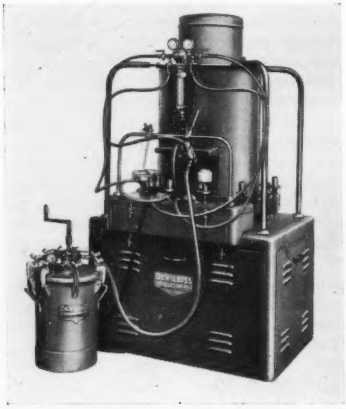


Fig. 3. Simple type fixed automatic spray gun with adjustable material delivery
(By courtesy of Aerograph Co. Ltd.)

the obvious economic one it would be of great value to be able to spray paint by a purely automatic process and much work has been done toward this end. Figs. 3 to 7 show automatic guns used for coating simple shapes but this is a far cry from mechanically painting large objects on a moving line. The

Fig. 4. Rotary spraying plant for toys and similar small objects
(By courtesy of Aerograph Co. Ltd.)



development of automatic spraying has been one of slow evolution, but it is possible that we are on the eve of a revolution in application methods almost comparable with the introduction of the spray gun itself. In motor-car plants both in this country and in the United States, experimental work has been taken to the stage where line painting of several hundred cars a day has been achieved by almost purely automatic methods as far as the primer or primer surfacer coatings. I know of no case in which baking synthetic enamel or cellulose finishing coats are so applied; but those who have carried out the painstaking work of perfecting the methods of automatic application are certain that as soon as sufficient experience has been obtained in the spraying of ground coats it will be a simple matter to extend the methods to the application of colour coats. It must be said, however, that the ease and success of automatic spraying are even more dependent on the design of the article to be coated than in hand spraying.

The interest in automatic spraying is universal and although the details differ from country to country and from product to product the trend towards complete mechanisation of painting is clear and obvious. The motor-car industry probably represents the application of these methods to the largest and most complex shapes painted by continuous line production methods. Many plants on both sides of the Atlantic are using automatic spraying at some stage in the painting of their bodies even though it is necessary for door shuts and body interiors to be painted by hand spraying.

Typical of American practice in many fields is the automatic primer spray booth at the Studebaker Plant. An article in Industrial Finishing (America), April 1954 indicates that this company is using fixed low pressure atomising guns which spray into an electrostatic field created between a charged wire grid and the earthed work and conveyor. The atomised paint droplets are urged along the lines of electrostatic force and are deposited upon the work. The claim made is that this process enables about 3 mils of primer to be applied

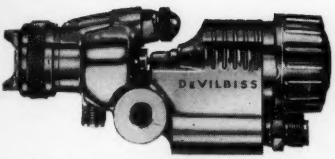
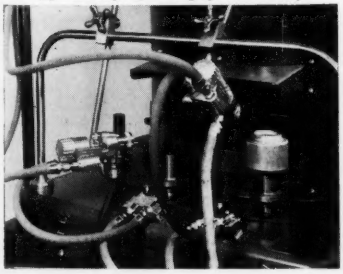


Fig. 5. (Above) Typical low pressure spray gun as used for automatic spraying. Fig. 6. (Right) Automatic single gun plant for coating the interior of jerricans. Upwards of 30 million are painted on units of this type
(By courtesy of Aerograph Co. Ltd.)

in a single coat as compared with 1½ mils by hand spraying and the cost of the extra paint is more than covered by savings in labour and the value of the paint saved by the marked reduction of overspray losses. This method of electrostatic spraying is of course familiar in a number of spheres of work; it has been used extensively for painting drums, wheels, refrigerator panels and almost every class of work. The only comparable motor-car usage in England is the use of electrostatic spraying for spraying tractors. Fig. 8, and another installation in the Midlands for chassis and engine spraying.

The tendency in the British motor industry has been to use automatic methods based on the moving spray gun automatically maintained at constant distance from the surface to be coated, and at a uniform angle to it. This method which is also used in the United States has been developed from the earliest schemes of automatic spraying used for flat sheets and other simple shapes where the spray gun was mounted on a moving arm. A typical current version of this which has been used for motor-car bodies in England is an automatic Schweitzer equipment in which the spray gun is moved by cams horizontally at right angles to direction of movement of the work. These cams are made up by clamping suitably shaped segments on to the edge of a wheel. A number of cams may be mounted on the same shaft and the appropriate one brought into operation by a simple gear change device. This enables the Schweitzer equipment to be used on a line which carries simultaneously a number of different bodies and it is not difficult to arrange for the cam change gear to be operated mechanically by a servo motor device. The motor body to be painted is carried past the spray guns on a fixed speed overhead or floor track conveyor while a rack and pinion type gear on the monorail and body jig causes a steady rotation of the body about a longitudinal axis; every point on the body surface thus describing an equiangular spiral. Since the function of the cam is to keep an even distance between the surface to be coated and the spray gun, it is clear that the cam and conveyor motions must be perfectly synchronised or the correspondence between gun and surface would be destroyed. It is a matter of common observation that the movement of a heavily laden conveyor is a series of irregular jerks which would quickly get out of step with the gun cams.

Fig. 7. Detail of toy and game spraying automatic machine using principle of fixed low pressure guns and rotating turntable both of which are clearly shown
(By courtesy of Aerograph Co. Ltd.)



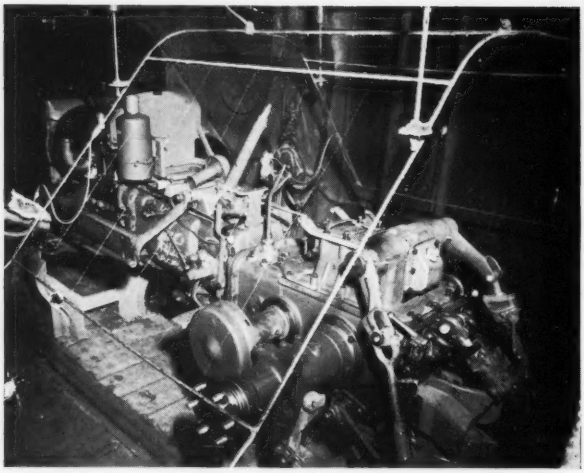


Fig. 8. Electrostatic painting unit for tractors, showing wire grid and low pressure atomising guns

(By courtesy of Ford Motor Co. Ltd.)

Special track side mechanisms had to be devised to smooth out the irregularities of motion before this method of application could be put on the production line. This consists of a secondary chain independently driven in synchronisation with the cam. This chain is set to run at a speed which gains slightly on the main track. A dog on the secondary track engages with the driving plate on the body skid and draws it free of the main conveyor dogs, for the length of the spray booth. At the end of the booth the auxiliary chain disengages and the main chain again takes over. Since the secondary chain is carrying only one or two bodies its motion is smooth. Fig. 9 shows a Canadian installation of this type which successfully paints car roofs without revolving the body. The line deals with about forty-five bodies an hour. Roof painting is a particularly valuable application as the increasing width of modern cars makes manual roof painting difficult. Fig. 10 shows a two gun set up for painting wings and hood tops using guns moving in a vertical plane on a lazy tongs mechanism. Other work holders carry different pieces past the same guns so that this system sprays all the loose parts including stone deflectors, instrument panels and interior mouldings. About 95 per cent. coverage is claimed from one machine. It is usually found that wherever hand touch up is required the operator responsible for the machine supervision can handle it.

Electrostatic Spraying

Electrostatic spraying has been briefly mentioned and after nearly 10 years use in this country the principles of the Ransburg "Number One" electrostatic spraying system need no more description than has already been given. It was the pioneer process in the application of electrostatic forces to the application of paint and the earliest successful attempt to introduce economy of material into spray application. The later "Number Two" process takes us out of the field of the conventional spray gun into a region of airless atomisation. The importance of this development will quickly be realised. The supply of compressed air for painting requires the installation of large capacity compressors; a single spray gun of industrial calibre will consume about 7 to 10 c. ft. of air a minute. Compressed air is liable to be contaminated by oil, water or particles of rust derived from the air lines if they are not of non-corrodible metal. All these are potential sources of trouble in the paint shop. It is not surprising, therefore, that the process though confined to automatic application, since the atomising unit cannot

be held in the hand, has aroused much interest. The method of securing the atomised cloud of paint necessary for spraying is to feed paint at low pressure and at a controlled rate on to the surface of a cone rotating at about 3,000 r.p.m. Centrifugal force throws the paint to the edge of the cone where it enters into the electrostatic field of force generated between the high voltage charge on the cone and the earthed work. This field causes the now charged paint droplets to be attracted to the article to be coated and then discharged. The process combines all the economy achieved by the abolition of overspray with a high quality of surface finish due to great reduction of spray mottle or "orange peel." Both electrostatic processes are flexible in the sense that they can be combined in various ways with fully automatic application and with such methods as hot spraying or steam spraying.

Hot Spraying

Hot spraying has had a chequered history not due to any theoretical unsoundness in the underlying principle but because of the practical mechanical difficulties of translating those principles into industrial practice. It seems, however, that the major problems of heat transfer, prevention of build up of paint and blocking of pipe lines have been solved and rugged equipment is now available to stand up to the often inconsiderate usage of the factory. Hot spraying makes use of the well known fact that if a liquid is heated its viscosity drops rapidly. In the case of most paints heating to 160°-180°F. will reduce the initial viscosity to a mobility suitable for spraying without the corresponding reduction of total solids effected by the addition of thinners for the same purpose. It is, therefore, approximately true to say that by using hot spray about twice the weight of paint may be applied in a single coat without danger of sags and other film defects than could be applied by cold spraying. It is easier to atomise hot paint than cold and consequently lower air pressures may be used which help to give hot sprayed coatings their typical smoothness as compared with cold sprayed films. This reduction in air pressure also results in less waste of paint by overspray and bounce. It is often true that all the advantages claimed above cannot be realised simultaneously but a compromise selection has to be made.

For large production use the paint is drawn off from the paint supply line from the central mixing department, the heater being situated in the fluid hose between the main line and the gun. Thus only a relatively small quantity of paint is heated at one time and the thermostat which is incorporated in the heater circuit automatically allows for the drop of temperature in the pipe line. This is only suitable if spraying is carried on continuously. For intermittent work-

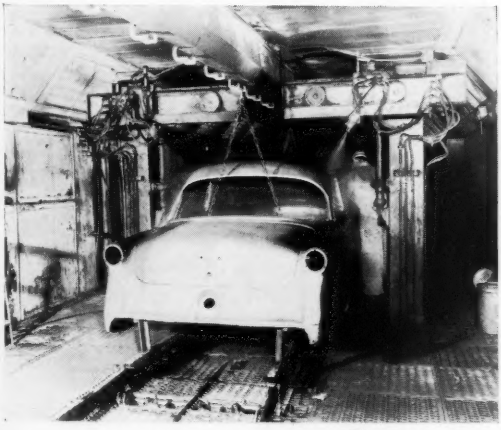


Fig. 9. Schwietzer Automatic Roof Spraying Machine installed at the Ford Motor Co., Oakville, Canada. It sprays some forty-five jobs per hour and has pneumatic trips to pivot units out of the way if a truck comes down the conveyor. Spray is controlled by mechanical pneumatic trips shown at the bottom of the picture

(By courtesy of Carrier Engineering Co. Ltd.)

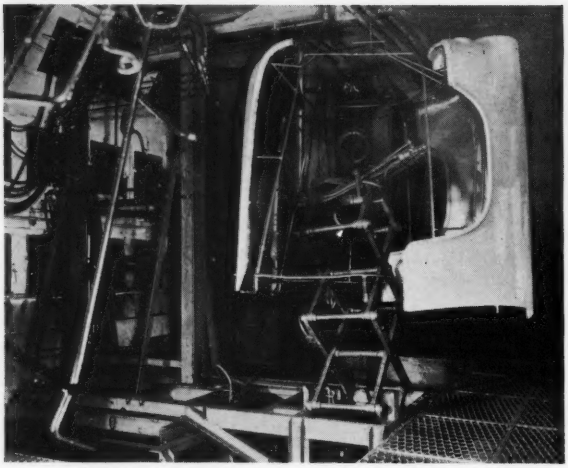


Fig. 10. *Schweitzer Automatic Inside Sheet Metal Spray Machine at the Ford Motor Co., Oakville, Canada. Using two guns it gives approx.* 959° *coverage*

(By courtesy of Carrier Engineering Co. Ltd., and Ford Motor Co.)

ing or drawing from an original container a pump or air pressure is used to draw off paint and a small quantity remains circulating whether the gun is in use or not. Pressure and temperature are readily controlled at the unit and in many models the atomising air is also given a measure of preheating. Units capable of handling up to ½ gal. of paint a minute are available. Typical units are shown in figs. 11 and 12.

The effects produced by a change from cold spraying to hot spraying may be remarkable even if the same paint is used with only an alteration in solvent balance in favour of higher boilers. The maximum benefit which the process is capable of yielding can only be realised with the co-operation of the paint chemist. An experienced paint maker will often effect quite a radical change in formulation to meet the new conditions. Since the amount of solvent left to evaporate from the sprayed film is so much smaller than with cold application, film shrinkage is correspondingly less and so hot spraying tends to increase build and filling power. This is, of course, a great advantage when metal quality is not all that it might be. The paint shop, however, must be on its guard against this or any other technical

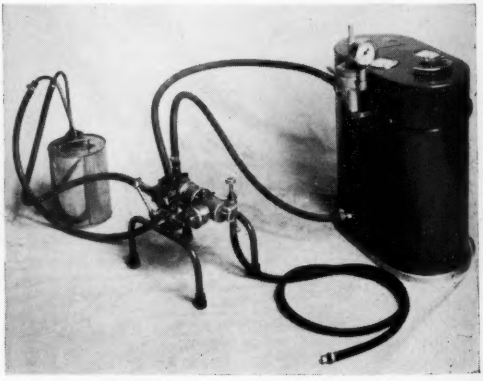


Fig. 11. *Small production hot spray unit in which paint is drawn from original container by a pump and passed into the heater unit*

(By courtesy of T.C. Spray Finishing Systems)

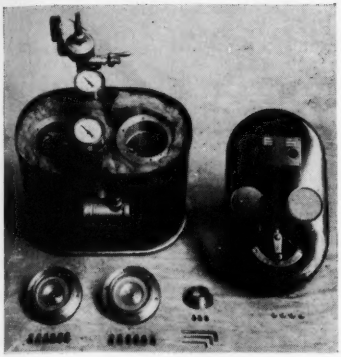


Fig. 12. 4 *kW hot spray unit in which paint is drawn from pressurised distribution system*

(By courtesy of T.C. Spray Finishing Systems)

improvement being made an excuse for lowering metal quality since the most costly way of dealing with metal defects is to smother them in the finishing department.

Conclusions

The processes described above have their drawbacks as well as their advantages. They introduce new and often complex mechanism into the finishing shop and lack the flexibility of a good spray man. It is in the nature of things that as tools become more specialised their scope is reduced and the most highly mechanised processes tend to evolve into single purpose machines. So to some extent it is with automatic spraying and hot spraying. Colour changes cannot be rapidly effected so colour production has to be batched. Every alteration in design means full scale experimental work in the development paint shop to adapt the automatic guns to the new conditions. But taking all in all these are small prices to pay for the savings and uniformity achieved by automatic application and are no different in kind from the conditions imposed by mechanisation in the tool room or press shop. The climate of industrial finishing today favours as never before automatic and mechanical methods.

Spraying in both its older and newer guises has been discussed in some detail since outside the structural coating field of houses, civil engineering installations, ships and the like, most paint is applied by spraying. This not to say that such methods of surface coating as dipping and flow coating have not made progress during the years under review. The advances made in these fields have, however, been in the nature of small gains in facility made possible by improved formulations, newer materials of improved properties and stability rather than the sweeping changes from manual to automatic spraying and to airless atomisation that have taken place and are still taking place in the domain of sprayed paint films. These advances in the technique of application have been accompanied by improved booth designs, better air conditioners, more efficient stoves and a growing measure of scientific control of raw materials and finished paints. All these things have combined with the new processes described to lower cost, increased durability and enhanced appearance—the aims of every one engaged in the art of organic finishing.

(*Continued from page* 183)

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Finishes at Scottish Industries Exhibition

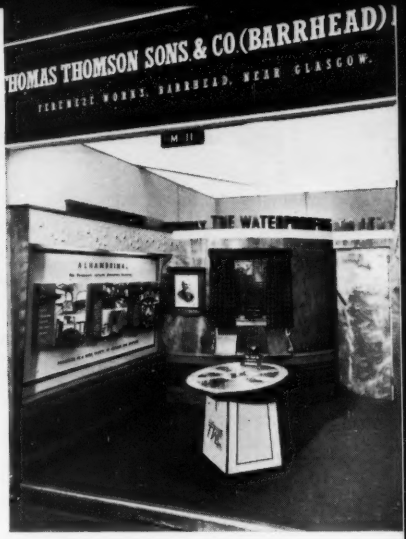
(BY A SPECIAL CORRESPONDENT)

Left: The stand of Dalzell Electric Welding Co. Ltd.

FIRMS at the Scottish Industries Exhibition whose products relate to industrial finishing occupied stands ranging from the large to the smallest in the show. Scottish Paints, Renfrew, were sited in one of the main avenues, R. Y. Pickering and Co. Ltd., manufacturers of high vacuum plant, had a sizeable stand amid a cluster of firms dealing with electrochemical deposition and metal spraying, and in this same neighbourhood was the Jenolite display, which despite its diminutive size, was a constant source of attraction.

Scottish Paints drew popular attention by a glass case of genuine coral from the Australian Great Barrier Reef—larger pieces of which were featured as part of the display arranged on the recent visit to the Queen to Townsville, Queensland. This was a striking advertisement for their "Coral Brand" paints. A model of the new Renfrew airport terminal buildings, which have been finished throughout with the firm's paints, was another eye-catcher, and on the walls

Left: Products "Fescolised" in chromium, including a propellor dome and light alloy engine cylinder, were a feature of the "Fescol" stand. Below: This Ford V-8 cylinder block demonstrated the cleaning properties of "Ardrox" on the stand of Brent Chemical Products Ltd.



Above: Eyecatchers on the Scottish Paints stand were a model of the new airport terminal bulidings at Renfrew (L.) and a showcase of coral from the Australian Great Barrier Reef (R.). Right: One of the most attractively designed small stands was that of Thomas Thomson and Co. (Barrhead) Ltd.

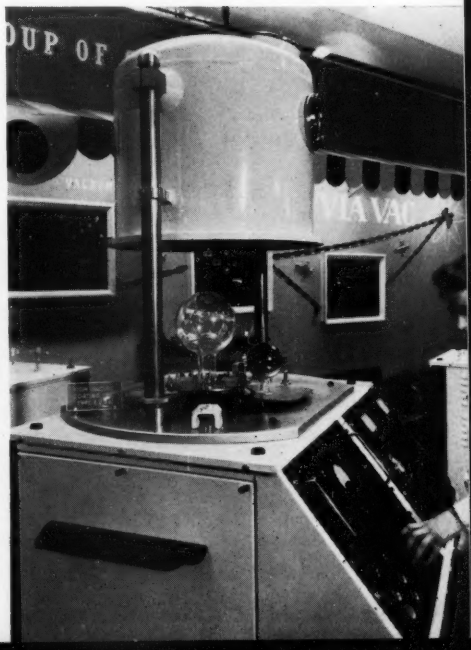
of the stand photographs illustrated the use of their paints and finishes in shipping, hydro-electricity, heavy and light engineering, decorating and housing. Regimental and clan crests finished by Scottish Paints were also on view and numerous articles demonstrated the results from usage of hammer, wrinkle and polychromatic finishes for such articles as ovens, scientific equipment, cars, and typewriter casings.

White air-drying enamels, a recent innovation, attracted special notice. These are based on epichlorhydrin condensation resin, noted for its resistance to caustic soda and useful for caustic soda baths, food cans, and machines where a paint-removing cutting oil is employed.

A woven fibre linen basket, made at the Royal Dundee Institution for the Blind, was finished with cellulose lacquer, as were a lamp standard, clock, small kilted figures and model yacht. A display compass containing an alcohol-resisting finish, a cistern finished with special aluminium paint, and a part of a coal conveyor belt finished with chlorinated rubber paint noted for its wear resistance and chemical inertness further illustrated the nature and variety of the firm's products.

The display stands and doors were treated with a special wood finish resistant to spirits and heat, and the stand itself was decorated with emulsion paint.

Laboratory instruments, showing the tests given to products before leaving the works, included an analytical appliance recently introduced by the Paint Research Association, capable of analysing pigment in two drops of paint.



Right: This high vacuum coating unit, manufactured by Vacuum Industrial Applications Ltd. attracted considerable attention

Vacuum Deposition

Vacuum Industrial Applications Ltd., a member of the Pickering Group of companies, showed samples of their range of high vacuum furnaces and special vacuum installations.

The method of depositing metals, such as aluminium, copper, silver, gold, etc., by vacuum evaporation is now being used on a large scale by many industries in a great variety of fields. The process relies basically on the principle of vaporising a small quantity of metal by means of a suitable filament or other heated source within an evacuated volume. Under these conditions vaporising takes place at a relatively low temperature and the vapour stream may be considered to travel in straight lines from the source, unimpeded by the effects of atmospheric air, and condenses in the form of a thin film on any surface placed in its path.

Equipment designed and manufactured in Scotland by V.I.A. Ltd., is available in both a range of standard sizes and a range of special-purpose machines. The variety of articles which may be processed in these machines is extensive and includes scientific applications in the optical and electrical industries, the manufacture of motor-car reflectors, torch reflectors and vehicle trim, as well as three-dimensional metallised transparent plastics, horn buttons, name plates and decorative metallic films on the exterior surfaces of plastic and metal articles, such as toys, costume jewellery and ornaments.

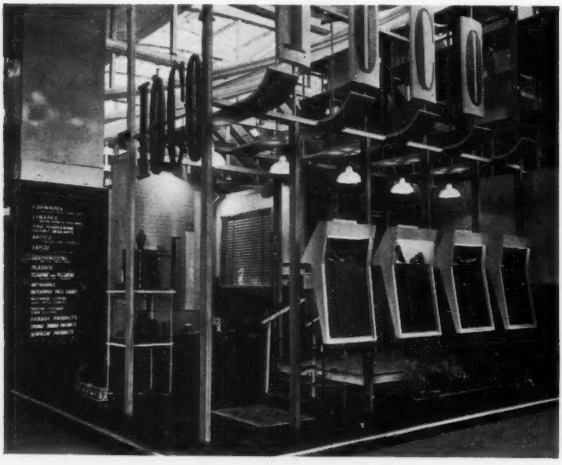
To ensure maximum output per cycle, systems of jigging of the articles to be processed are essential, and the firm supplies suitable jigs and filament assemblies to meet any requirements.

Simple plane surfaces without deep grooves and elaborate contours may be processed on plain stationary jigs. More complex articles may require some rotary arrangement and "over-all" coating of the components necessitates a planetary jig design. Consideration is also given to the effects of a relative position between the vapour and objects to be coated by providing special filament assemblies, the type and number of which determine the thickness and distribution of deposit. The design of vapour source is dependent on the material to be vaporised and may take the form of filaments, boats or small crucibles.

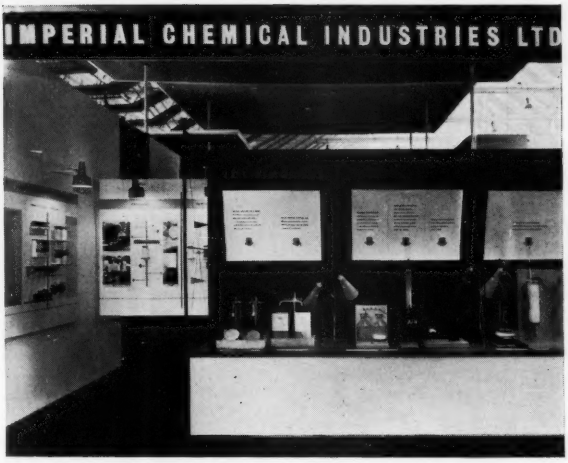
A representative plant of the VIA-VAC range of coating units gave visitors to the stand an opportunity of seeing the latest developments in vacuum technology.

Vacuum Metallurgy

In recent years the metallurgical industries have shown an ever-increasing interest in the possibilities offered by the processing of metals under



Ioco exhibited examples of "Linapex" fabrics coated with selected insulated stoving varnishes and "Silopex" insulating, silicone varnish impregnated fabbrics



A corner of the I.C.I. stand on which "Cellofas" cellulose derivatives, industrial nitrocellulose, etc., were displayed

vacuum or in controlled atmospheres. The application in the metallurgical field include melting and casting, heat treatment, such as normalising, annealing and spherodising, sintering (powder metallurgy) as well as degassing and purification of metals, and vacuum etching. In addition, a number of reduction processes for the preparation of metals from their salts may be conducted at low temperatures under vacuum conditions.

In Scotland V.I.A. Ltd. produce, for the applications mentioned above, high vacuum furnaces and special vacuum installations ranging from laboratory-scale plants to full-scale production equipments. The smallest of the laboratory units was shown and demonstrated on the company's stand. This equipment is specially suited for experimental and investigatory work on a laboratory scale as well as the production of small melts up to 2 lb. (copper). A number of interchangeable accessories enable the equipment to be converted for a large variety of metallurgical applications. The material within the chamber may be heated by means of either a molybdenum resistance heater or, alternatively, by a small induction coil powered by a portable generator set.

Sectioned and etched samples of vacuum cast metal demonstrating the advantageous crystal growth, uniformity of structure and freedom from porosity obtained by the vacuum process were on view, and the equipment was in operation producing small ingots of super-pure copper and aluminium.

The I.C.I. stand included a display of the chemical products of the Nobel Division, world-famed for its commercial blasting explosives and accessories, but now engaged in the manufacture of other materials in ever-increasing quantity and variety. The uses to which this company's wide range of "Cellofas" cellulose derivatives can be put was illustrated by illuminated display boards. These derivatives are stabilising, thickening, and emulsifying agents, whose versatility makes them useful in a wide variety of industries.

"Cellofas A," consisting essentially of methyl ethyl cellulose in the form of a white, fluffy solid, is used in water paints, ceramics, industrial emulsions and foams. It is soluble in cold water but insoluble in hot water. It is outstandingly successful as an emulsifying and foaming agent and is also useful for its thickening, suspending and binding properties.

"Cellofas B," soluble in both hot and cold water, is a water-soluble sodium salt of carboxymethyl cellulose with valuable suspending, thickening and binding properties, comparing favourably with many of the natural gums while having advantages in respect of uniformity and

stability. It is an excellent stabiliser for emulsions but has only a limited usefulness as an emulsifying agent. It is used in water and emulsion paints, ceramics, textile finishing, leather treatment, paper manufacture and finishing, detergents, adhesives, industrial pastes, emulsions and suspensions.

"Cellofas C," a grade of sodium carboxymethyl, soluble only in alkali, is used in preparing durable finishes for textiles.

Nitrocellulose plays an important part in the protective finishing industry and the stand bore witness to the extent of the I.C.I. range of industrial nitrocelluloses. The remarkable range of viscosities available allows great flexibility in formulation, and this, combined with fast drying and good compatibility with a large variety of resins and plasticisers, has given nitrocellulose a very wide field of application.

Industrial nitrocellulose is manufactured by Nobel Division in two main varieties—one made from cotton linters and in the form of a loose fibrous material, the other from woodpulp and in the form of compact grains. They may be applied as lacquers for wood and paper, metal and leather and in many other directions.

Another I.C.I. product of interest was "Nitromul" emulsifying agent, specially developed for use with nitrocellulose solutions. With its aid, nitrocellulose lacquers containing any of the usual resins, plasticisers and pigments can be emulsified quickly and simply to give emulsions with exceptional stability. This emulsion has a high solids content with a consequent reduction in the number of coats required. It is particularly useful on porous surfaces such as paper, fibreboard, leather and unsealed wood. On such surfaces one coat of emulsion followed by one coat of normal lacquer gives a better finish than three or more coats of normal lacquer alone

Attention was drawn to the merits of pentaerythritol, a pure grade of which is made by the Nobel Division for the manufacture of ingredients for high-quality paints, varnishes, lacquers, etc., and for many other uses. Although used mainly in the preparation of materials for incorporation in high-quality paints and varnishes pentaerythritol is also used for making waxes, plasticisers, emulsifying and wetting agents, etc.

Uses of Silicones

The qualities of silicones were likewise demonstrated. Silicones—a range of fluids, resins, elastomers and pastes —were added to the company's selling range in 1952.

The molecular structure of these products is based on the siloxane chain or ring consisting of alternate atoms of silicon and oxygen—essentially the same basic structure that occurs in the silicate minerals. In the silicones, however, the basic siloxane structure is modified by the presence of organic groups such as phenyl and methyl radicals. The molecule as a whole, therefore, while having certain affinities with the stable and inert silicates, yet has valuable characteristics possessed by purely organic structures. It is the dual character of the siloxane molecule which gives it its unique properties.

Silicone elastomers will retain their flexibility at temperatures up to 280° C. and down to −85° C. and silicone fluids show a much smaller change of viscosity with temperature than do equivalent mineral oils. Silicone aluminium-based paints will withstand temperatures at which normal aluminium paints deteriorate badly. Silicone elastomer gaskets can be used where conventional rubber stocks would disintegrate. Silicone resins allied with mica or glass insulation can be used in electrical equipment to allow higher operating temperatures than could be permitted with normal insulation.

Silicones, as was exemplified by exhibits on the stand, have a high water repellency. They can be used to protect building structures and to waterproof glassware and ceramics, and by adding to car and furniture polishes increase gloss and water repellency. Silicone fluids and resins are useful also in the rubber, plastic and dye casting industries, while silicone emulsions are effective in preventing or breaking rapidly a wide variety of troublesome industrial foams.

Although the Nobel Division is at present importing silicones from America an I.C.I. plant has been designed and will produce the complete range of products in this country.

for a better finish at lower cost

More and more manufacturers are using the Hot Spray painting process for their product finishing. Whether they produce wooden kitchen cabinets, or metal goods such as washing machines or safes, they find that the use of pre-heated paints speeds up production, and provides a better finish at lower cost.

Wide choice of John Hall finishes

John Hall's of Bristol can supply air-drying and stoving enamels, polychromatics, wrinkle and hammer finishes, cellulose lacquers, enamels and fillers . . . all suitable for application by Hot Spray plant.

Try this free 'test finish'

Why not send us one of your products for an expert 'test finish' and opinion? If the Hot Spray process is suitable for your product, we will show you how best to use it. If it is *not* suitable we may be able to save you expensive 'trial and error'. The process requires experience and knowledge to obtain the best results. As specialist manufacturers of industrial finishes we have the *know-how*, which we gladly place at your disposal.

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Demonstration Centre

JOHN HALL

JOHN HALL AND SONS (BRISTOL AND LONDON), LTD., HENGROVE, BRISTOL 4

This general purpose jacketed vessel, one of the first to be fabricated in "Colclad" steel, was shown at Colville's stand

At the stand of the Dalzell Electric Welding Co. Ltd., visitors saw examples of the DEWCO metal finishing process. This firm is noted for its phosphatising of metal, and their up-to-date process gives a high-grade phosphate coating to steel fabrication that will withstand the action of atmosphere conditions over long periods. The phosphate coating, approved by the Air Ministry and the Ministry of Supply, is not a surface layer, but is embedded into the metal surface, penetrating in between the grain boundaries.

The company has one of the largest metal processing plants in the country, equipped to treat heavy steel fabrication in large quantities.

DEWCO make road tankers of all kinds for the specialised needs of oil, gas, chemical, food and other industries and particularly specialise in tanker fabrication in "Colclad" steel, a product of Colvilles Ltd.

An example of "Colclad" steel lining, which is bonded on to mild steel, giving the same results as from stainless steel, was seen at the Colville's stand in the shape of a large chemical tank.

Chromium- and Nickel-plating

Electro Platers Ltd., drew attention on their stand to the services they provide in the way of chromium- and nickel-plating. The advantages of an electro deposit of cadmium or zinc in protecting articles of steel or other ferrous alloys from rust and corrosion were also exemplified.

Chromium finishing of light alloys, which provides a surface very much harder than steel and is particularly valuable in the aircraft and automobile field, was shown by Fescol Ltd., together with other examples of their electro-deposition work. This firm which originally undertook only nickel deposition, was one of the first to go ahead with the deposition of commercial chromium. A Scottish works was opened in 1949 and now deals with the deposition of chromium on the same scale as exists at the London works with a somewhat lesser nickel capacity. There are facilities for further expansion as the demands on the plant develop.

One of the oldest companies in Scotland associated with industrial finishing is the Larbert Art Metal Co. Ltd., which originated as a local family business in the closing years of the nineteenth century. At first the company was concerned with such products as copper stampings, canopies for fireplaces, fenders, hearth sets, coal boxes and other beaten work, most of it manufactured by hand.

At the same time nickel- and copper-plating were carried on as ancillary finishing techniques and work in the plating field developed. In 1926 chromium -plating was added to the existing facilities and rapid expansion of outwork-plating followed, mainly for this new electro-deposited finish.

Today, the company is able to offer nickel and chromium, hard chrome direct on steel, copper, zinc, cadmium silver, tin, Speculum-plating and gold-plating for the linings of silverware.

Parallel with the development of their interests in electro-deposition came a new demand in the finishing field for stove enamelling of sheet metal components and fabrication, and for the bulk treatment of small parts to protect them against rust.

Among these were facilities for pre-treating the work prior to painting, to bond the finish to the base metal and to protect the work against corrosion by the then new technique "Bonderiz-

ing" and the adoption of "Parkerizing."

A recent addition to the firm's equipment is a "Parco-Lubrite" plant for the treatment of moving (ferrous metal) parts to reduce wear on friction surfaces, particularly during the early running-in period. This process reduces suffing, galling and risk of local welding and is now widely used for the treatment of such components as pistons, piston rings, cylinder liners, gears of all kinds, valves, rockers, cam shafts and similar pieces.

"Pylumin," one of the first processes operated by the company, is still offered for the treatment of aluminium and aluminium alloy surfaces prior to painting.

Varnished Fabrics

Ioco Ltd., provided examples of their "Linapex" varnished fabrics, comprising flexible electrical insulating material based on cotton, silk, Terylene and glass fabrics, etc. These are coated on each side with specially selected insulated stoving varnishes, designed to meet the many varying requirements of the electrical and cable industries. The base fabric acts as a vehicle for carrying insulating films of oxidised varnish and supplies the necessary mechanical properties to the varnished product.

Another of the firm's products, the use of which is constantly growing, is "Silopex" insulating fabric and tape. This consists of a woven glass fabric of great tensile strength, specially pretreated for removal of organic material and impregnated with a smooth coating of silicone varnishes. The silicone resins have a chemical structure similar to glass, consisting of a framework of alternately spaced silicone and oxygen atoms and are fundamentally different from the organic impregnating varnishes. This chemical structure is responsible for the remarkable heat-resisting properties of the silicone resins.

Waterproof roofing for railway carriages and wagons, and "Alhambrinal," a modern highly decorative permanent interior panelling, attracted attention at the pleasingly laid-out stand of Thomas Thomson Sons and Co. (Barrhead) Ltd.

"Alhambrinal" is produced in a wide variety of designs and colours and is used for the lining of ceilings, under-racks, body-panels and seat-backs in buses, motor coaches, railway carriages, etc. Since 1945 over 2,000 vehicles have been fitted with this interior panelling.

A placard on the Jenolite stand bore witness to the widespread use of this firm's products. Of the 216 exhibiting firms at the exhibition, 115, it was pointed out, used Jenolite products. Of the 99 engineering firms, 87 were Jenolite users.

Another use for Jenolite was shown by the brass and copper exhibits on a neighbouring stand, which had been cleaned with the product and looked bright and attractive.

A Ford V-8 engine and photographs of industrial products treated with "Ardrox" metal working chemicals were featured by Brent Chemical Products Ltd.

Visitors to the stand were particularly impressed by the manner in which carburettor parts could be effectively cleaned with "Ardrox" materials. This process consists essentially of removing the deposits of petrol gum, carbon, oil, grease and dirt by immersion in this fluid, followed by a special bright dip, which removes all tarnish and corrosion and restores the component to its original

(*Continued on page* 204)

Although the stand of Jenolite (Scotland) Ltd. was the smallest, it still attracted attention

Reducing Finishing Costs

by C. RAYMOND SYER

Continued from INDUSTRIAL FINISHING, *September*

Function of Solvent in Paint

Solvent nomenclature due to the large number of solvents available today and the different uses of each one presents a confusing picture to the average layman.

Solvents in paints have these properties or do these three things;

1. Disperse or dissolve resins or solids in solution.
2. Have transfer properties in carrying solids to product surface.
3. Have flow-out properties in deposited film.

To use functional descriptions (Application wise) in classifying the solvents:

1. Dispersion and carrier solvent.
2. Flow-out solvent.

All solvent evaporates or is forced out and does not become a part of the film itself. The employment of a solvent provides a means of transferring a solid from a container on to a product surface. When this transfer has been accomplished, the carrier solvent is of no further use and has to be evaporated as rapidly as is consistent with good paint film formation. It has completed its functional role. The flow-out solvent (usually slower evaporating than carrier solvent) plays a definite part in the formation of the deposited film; flow, wetting, levelling.

Solvent recommended by paint supplier should be used. It must be compatible with basic mix. The correct solvent should be either purchased from a paint supplier or from a reliable solvent supplier. Improper solvent or excessive diluents will kill gloss, lower build, throw colour off shade, increase penetration into wood surfaces.

Most all solvents lose solvency power with decreased temperatures: This point should be of particular interest to firms who have outside storage of solvent. It usually takes one day for a drum of solvent to come up to room temperature (dependent on outside temperature).

Efficient paint application hinges on use of proper solvents. Solvents are obtainable in relatively close evaporation rates and the paint is generally formulated with a solvent balance that will meet specific requirements and certain operating conditions. After proper solvent and temperature is qualified, evaporation rate is the next consideration. A rise of 20 degrees can increase the evaporation rate of a lacquer solvent (usually very fast evaporating) as much as 50 per cent. This is well known in lacquer application where films have poorer flow in hot summer months than in winter or autumn months if same solvent is used year around. When too fast evaporation occurs, flow-out is restricted and film rough. When evaporation is too slow, sagging results. If paint is applied at same level above fluctuating plant temperatures, evaporation rate is constant and uniformity of drying time is approached.

Controlled temperature application does not change film forming ingredients in the least. The primary interest of paint formulators should be centred on the volatile portion of the mix. Enamel, varnishes, vinyl paints are usually formulated with volatiles that evaporate slowly. It has been found that only in clear lacquers (mostly where very fast evaporating solvents are used) that the need arises for a much slower solvent. This need is due to the higher dissipation rate of the carrier solvent between gun and work. In room temperature spraying, approximately 20 per cent. of the solvent is dissipated between gun and work; at elevated temperature

Telephone: 0403-4 *Telegrams*: 'Toughness,' Birmingham

about 70 per cent. is knocked out between gun and product surface.

Evaporation rate of the solvent and not initial boiling point of a solvent should be used, due to the fact that solvents with the same initial boiling points have different evaporation rates. Generally evaporation point of the carrier solvent should not be exceeded by paint temperature unless heavier build and increased sag resistance is desired, or to compensate for insufficient flash-off time. This would compare with technique employed in room temperature spraying where either gun is pulled back in stroking or high atomising pressures are used.

Once solvent balance is established and one set temperature used to apply paint, the same formulation can be used the year round irrespective of seasonal changes.

Learn What Viscosity is Best and Hold To It

Uniformity in the finish of a product is an important factor in successful operations, and it is necessary to bring about repeat sales. Control is the basis of uniformity in any product, and this extends to uniformity of the finish on the product.

Controlled finishing, with its accompanying improvement in the quality of the finish and economies in material and labour, is practical for the small plant as well as the larger plants. Every mixing room should be equipped for taking viscosity readings. For each type of material a viscosity point exists which is the best value for the purpose at hand.

There are various interpretations of the word "viscosity" as applied to paint, and sometimes the picture gets a little confusing. These are some of the most common definitions:

(a) Resistance to flow.
(b) Ease or rate of flow.
(c) Degree of thinness.
(d) Best point of flow.
(e) Measure of solution's fluidity.
(f) Rate of shear equals flow or viscous drag (silk screen).

However, the most popular definition is "resistance to flow."

Viscosity of a paint changes with temperature: in general, the same material will show lower viscosity at high temperature and a higher viscosity with low temperature.

Proper viscosity control can only be had if temperature control and the same cup is used. If temperature control is not used viscosity readings lose practically all comparison values, and batches of mixed paint are never the same.

Paint should be mixed first and reduced at one set temperature (majority use 77° F.) to get as constant a solids-to-solvent-ratio application viscosity as possible.

This temperature level is recommended for reducing due to fact that most paints are formulated at this level by paint supplier. If mixed and reduced at variable temperatures, a conversion chart can be made, or it might be available from the paint supplier.

Viscosity control is used to get film thickness control, colour, stability, performance, uniform coating, stabilisation of unit cost, reduce rejects, to save labour and standardise production conditions.

For the past several decades when we talked about lowering viscosity of a paint we meant the addition of solvent. Dilution by addition of a solvent gives more mix but at a lower solids ratio; 5 gallons becomes 7 gallons of paint. Now along comes temperature input in paints with an assertion that heat reduces viscosity. Our thoughts unconsciously travel to a picture of diluted material. It is true that heat reduces the viscosity (resistance to flow) but it does not dilute the material as the solids ratio is the same, volume remains the same, 5 gallons is still 5 gallons.

When material is reduced in viscosity by high heat input, the viscosity drops to one-third or one-quarter of room temperature viscosity. No comparison values have been established as yet which will permit charting. Charts giving cold and hot paint viscosities, where percentage of solvent is added to get viscosity of 16 seconds at room temperature against paint heated to 150° to get same viscosity reading are of no worth. The cold mix applied at room temperature will give, say, a ·0007 in. film thickness and the heated paint will produce at least one-and-a-half to two times the film thickness.

If comparison data would be forthcoming from paint suppliers or any other interested source, where comparison is on dry film thickness, equal values would be used and data could be used intelligently. Room temperature viscosities would be charted as to what dry film thickness they will produce when applied at room temperature. Cold mix viscosity, viscosity after heating and resultant dry film thickness would also be charted of the material applied at elevated temperature.

Material used would be the same, and square foot coverage noted, and then an efficient cost evaluation point of the particular paint used could be had.

Heat input should be used only to lower viscosity (resistance to flow)—material should be reduced to get desired film thickness. Heat is a natural means to bring down the viscosity (resistance) without sacrificing solids content.

110 Degree Temperature Control Level

This temperature control level is utilised mainly at application point for operational efficiency, uniform high workability of material. An ideal application temperature is something above fluctuating plant temperatures and 110° F. is generally used. A quality coating can be had during entire painting operation, regardless of weather, season or time of day. Viscosity is controlled, which gives assurance of uniform film thickness and unit cost is stabilised. Practically all finishes can be used at this level. Paint mileage is increased through decrease of painting rejects and efficient workability of the material throughout the operation.

Especially beneficial to:

Users of paint which is stored outside or in unheated building.

Users of automatic application machines, automatic spray, electrostatic #1 and #2, dip tank, flow coat, roller coat, centrifugal.

Smartest economy is practised by users of clear lacquers, varnishes, hammertone, wrinkles or any other material furnished at application viscosity.

Users of high viscosity material (example is cold 27 per cent. solids lacquer) where inefficient application at room temperature is tolerated to get additional build.

In eliminating cold morning starts, in late spring, where plant heat is discontinued, early autumn where heating plant is not functioning, in operations around the clock, high bay buildings where plant temperatures cannot be maintained uniformly throughout the day, open-air spraying.

Actual dry film thickness and not number of coats is the point to consider. Any excess in film thickness merely increases costs.

In many plants air pressures and viscosities have been determined, but upon making a test I have found them to be incorrect, resulting in waste and excessive cost. Baking schedules and temperatures have also been determined, and also found to be incorrect, retarding productivity and running

Viscosity of a Paint Changes with Temperature.

Temperature.	*Fahrenheit*	30°	77°	90°	150°	180°
Viscosity.	*Seconds*	70	38	34	15	14

Variable viscosity, inconsistent material	*Stabilised viscosity, consistent material*
Variable film thickness	*Uniform film thickness*
Viscosity juggling—solvent or unreduced paint additions	*None necessary*
Orange peel	*Smooth film*
Variable drying time	*Same*
Gun, fluid adjustments necessary	*Adjustments stable*
Continuous modification of application techniques	*Same high operator efficiency*
High reject rate	*Rejects at a minimum*

heating costs far above what it should actually be.

I have been in large industrial plants where production quantity would warrant a conveyorised system. Such a system in type of plant would prove economical, and the cost of installation could be met from savings earmarked over a period of 12 to 18 months, which would be apparent in increased production per man, etc.

Conclusions

To obtain a desired finished appearance, which has durability, mar-resistance, non-fading, together with sales and eye appeal qualifications at the lowest minimum cost, it is imperative that the selection of the correct type of materials are used. It is also essential that a control system for the use and application of same is in order. Correct procedures of handling materials, upkeep of equipment, good housekeeping, and all operations from cleaning through final finishing room operation should be conducted.

When faulty or careless procedures are allowed to exist, finishing costs will be excessive, productivity will be held at a minimum per man, and sales will obviously be effected. Finishing difficulties will always exist as long as climatic conditions, human error and varying methods of application are not under complete control.

By close observance of certain rules, experience, interest in doing the work carefully, there should be little difficulty with high-grade proven materials.

The quality and appearance of the finished job depends on the care taken in the application of each individual operation. A series of careful operations must certainly give a smooth, satisfactory finish. The finish possessed by any object, whatever it may be, constitutes a very considerable portion of its sales appeal, and also provides the necessary protection from the elements. It naturally follows, therefore, that the more carefully and efficiently the finish is applied the greater will be the return in sales, satisfaction and service.

ELECTRONICS AT WORK

THE first trade electronics exhibition to be held in the Midlands will take place from the 23rd to 25th November at the Chamber of Commerce Hall, the following firms of finishing interest will exhibit:

Baird and Tatlock (London) Ltd., demonstrate a photoelectric self balancing absorptiometer for process control, an electrometric titrimeter for the determination of the brine number of oils, an ultra-sonic generator, and a monitor for use in schools and technical colleges for experiments in radiochemistry.

The photoelectric self balancing absorptiometer has a wide application in industry for the automatic control of a chemical process. It is intended for the continuous measurement of small changes in colour intensity of liquids flowing in a chemical process, and, in conjunction with an external controller, will provide a complete system for continuous indication, recording and automatic process control.

A. C. Cossor Ltd. are demonstrating oscillograph cameras, camera drive units, and pre-amplifiers.

Electronic Instruments Ltd. demonstrate a range of *p*H meters, milliohmmeters, and megohmmeters, an automatic titrimeter, and a highly sensitive vibrating condenser D.C. amplifier.

The E.I.L. automatic *p*H titrimeter enables chemical titrations to be performed automatically without human intervention to a high degree of accuracy.

I.M.F. Organic Finishing Group.—The paper "The Blistering of Paint Films on Steel Services," by A. Nicholson and H. A. H. Jenkins, will be presented at the Organic Finishing Group meeting to be held on the 26th October at the Chartered Auctioneers and Estate Agents Institute, Regents House, Colmore Row, Birmingham 3, at 6.30 p.m.

(*Continued from page* 199)

lustre. In addition, all brass parts on the component take on their former brightness.

Charles Lindsay Ltd., in addition to showing reproduction brassware and hearth furniture, drew attention to their work as electro-platers in chrome, brass, copper and silver.

If proof were needed of the important, if not vital part, played in industry today by manufacturers of industrial finishes of all descriptions it was undoubtedly afforded by the number and variety of these products in Glasgow's Kelvin Hall at an exhibition of which Scotland could be justifiably proud.

Praised in the Showroom . . .

proved in practice . . .

Attractive, durable, easy to apply, MANDER'S Flamboyant Enamels increase sales appeal and give thorough and lasting protection. They are offered in a wide range of exceptionally brilliant and transparent colours, in stoving and cellulose qualities.

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Effect: Savings in production costs and economies in material consumption.

They will always improve the quality of your finish. Our exceptionally wide experience of Industrial Finishing, makes all this possible.
Call us in now and save.

M A N D E R ' S

Flamboyant Enamels

MANDER BROTHERS LTD., WOLVERHAMPTON

S.B.A.C. SHOW—FARNBOROUGH

VISITORS to this year's Society of British Aircraft Constructors Display at Farnborough noticed a much larger permanent site for the static exhibition, set on high, well-drained ground. The floor area of the new, attractive exhibition hall is 100,800 sq. ft.; this year it contained 292 exhibitors. Finishing firms which exhibited at the show were:

Cellon Ltd. **Stand 187**
Kingston-on-Thames
This firm's display included specimen and literature on aircraft finishes formulated to provide maximum protection under modern flying conditions, high speed finishes, ester lubricant resistant finishes, anti-corrosive primers, Celloseel jointing compound and exterior and interior schemes for civil aircraft.

Docker Bros. **Stand 192**
Rotton Park Street, Ladywood, Birmingham 16.
Literature and panels shown concerned external and internal aircraft finishes to meet all Admiralty, Air Ministry, and civil requirements, industrial finishes for airport buildings, vehicles and equipment.

Imperial Chemical Industries Ltd. (Paints Division) **Stand 125**
Wexham Road, Slough
I.C.I.'s exhibits dealt with a full range of aircraft finishes to A.I.D. and defence specifications and A.R.B. requirements, an etching primer, fire-resisting clear and coloured dopes, Aero Du-lite, lightweight finishes, E.L.O.R. finishes and metal pretreatments.

Jenolite Ltd. **Stand 234**
43 *Piazza Chambers, Covent Garden, London,* W.C.2.
Information and samples on the stand contained a rust remover and neutraliser (for ferrous and non-ferrous metals), chemical sealer (anti-corrosive paint), aluminium cleaning powder, aluminium keying solution (corrosion inhibitive preparation for painting).

John Hall and Sons (Bristol and London) Ltd. **Stand 95**
Romilly House, Petherton Road, Hengrove, Knowle, Bristol 4.
This display described and illustrated a liquid envelope for temporary protection, storage or export, dopes, lacquers, paints, varnishes to D.T.D. specifications, high speed finishes, white top finish for fuselages, and an anti-corrosive varnish for engine interiors.

The Pyrene Co. Ltd. **Stand 70**
9 *Grosvenor Gardens, London, S.W.*1.
On this company's stand are displayed aircraft fire and safety equipment; fire extinguishing systems for aircraft and airfield, using CO_2, wet water, dry chemical, chlorobromomethane, methyl bromide and foam; smoke and fire detectors, and aircraft wheel chocks.

Titanine Ltd. **Stand 154**
Sheaveshill Avenue, Colindale, London, N.W.9.
This firm's exhibits concerned aircraft finishes to current A.I.D. and A.R.B. requirements, finishes for special requirements of supersonic flight, and exterior and interior finishes for civil aircraft, airport buildings and equipment.

Nu-Swift Chloro-Flash Extinguishers for Danish Air Force.—Nu-Swift have announced the receipt by them of the first order for their Chloro-Flash extinguishers, charged with chlorobromomethane, for use in aircraft of the Royal Danish Air Force.

Change of Trade Name.—Winston Products Ltd., Hampton Hill, Middlesex, have discontinued the use of the trade name, "Voltastat" because it is similar to a trade name used by another electrical manufacturer. Instead, "Constavolt" will be used when the stabilised voltage control equipment is designed for battery charging, etc., and "Magnetrol" when used for rectification, battery elimination and similar purposes.

"Craftsmen Welders."—A preview of a prestige film entitled "Craftsmen Welders" was recently given in London by Babcock and Wilcox. Emphasising the complexity of the large modern boiler on which thousands of welding jobs have to be done on site, this film sets out to show the thoroughness of this company's methods of training the site welder, who is now so important. The scope of the training course is explained in the form of an interview with two new entrants—one joining the oxy-acetylene, the other the metal arc course at Tipton in Staffordshire. The film surveys the training of both from the lowest to the highest welding grades. They are shown receiving instruction in the magnetographic method of non-destructive examination of butt welds developed by Babcock and Wilcox.

DEDICATED to your SERVICE

A problem presented is a problem solved—when placed before this organisation of technical specialists in metal cleaning and stripping. "S.A.C." service is nation-wide—its representatives able to advise you on the spot—its recommendations backed by the most up-to-date laboratory and manufacturing facilities. "S.A.C." processes cover every phase of cleaning, servicing and protecting all metals during manufacture and maintenance.

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RECENT DEVELOPMENTS

MATERIALS : PROCESSES : EQUIPMENT

PLATING BARRELS

THE "Typhon" plating barrel recently marketed by Wm. Canning and Co. Ltd., Birmingham, has been adapted because of a good reception by the plating trade, to cover a range of three barrels. The adaptations are: Typhon Minor with an article capacity of 1 pint; Typhon Major with an article capacity of 2 pints; and the Typhon Master with an article capacity of 2 to 3 gals.

The barrels are rotatable during discharge and are useful in plating small components that cannot be treated in perforated barrels. The "Minor," requiring only 7 pints of solution, is especially suitable for deposition of precious metals.

RAPID STRIPPER COMPOUND

A COMPOUND which is said to strip enamel, lacquer and hammer finish coatings almost instantaneously from metal surfaces is being manufactured by V. J. Dolan and Co., 1830 N. Laramie Avenue, Chicago 39, Illinois.

The stripper, which can be applied by spraying, flow-coating, or by brush, is said to operate so rapidly that stripping and repainting processes can be turned into continuous cycle production operations. The stripper compound is said to be both non-inflammable and non-toxic.

LONG LIFE FURNACE ELEMENT

A ONE-PIECE silicon carbide tube element for electric furnaces, marketed under the name of "Crusilite" by the Morgan Crucible Co. Ltd., Battersea, is claimed to have many advantages over metallic and normal silicon carbide elements. The central hot zone is in the form of a spiral of the requisite length and, because the element is jointless, a constant source of failure is avoided. It has a slow rate of ageing and operates over a wide range of element temperatures from 800° to 1,575° C.

Where the furnace designs permits, special metal caps shrunk onto the metallised ends of the elements form a highly efficient terminal arrangement. Stock sizes are from 10 to 28 mm. dia. and 180 to 500 mm. hot zone length.

MINERAL OXIDE BARREL CHIPS

LACRINOID PRODUCTS LTD., Gidea Park, Essex, are now marketing mineral oxide chips under the brand "Lacron" for barrel finishing of all metals. These chips are claimed to approach the diamond in hardness and are produced in nine sizes from 2 in. down to $\frac{1}{32}$ in. They are designed to descale, deburr, burnish and polish all metals in conjunction with conventional compounds. It is stated that depreciation, depending on component treated, may be as low as 0·2 per cent. per run.

The chips can be used in any existing tumbling equipment and, due to their good cutting power, are said to reduce running time considerably.

POLISHING CLOTH

A polishing medium claimed to be unique is coated with granulated cork on a waterproof backing, combined with a polishing agent in the resin band. Made by the Minnesota Mining and Mfg. Co. Ltd., Birmingham, it is for polishing only on glass, ceramics, plastics, wood and metal. It is available in most converted forms—rolls, belts, discs and sheets, with a maximum width of 28 in. with one granule size only, approximately 20 to 24 mesh.

HYDROSTATIC DUST COLLECTOR

A NEW type of Dallow Lambert dust collector has been added to the present range of patent Multiswirl models.

Previously available in the MSE series and applied in the main as an individual unit for fettling booths, double end polishers and grinders, the new series ME is available to handle large volumes of air and heavy dust concentrations.

In the manufacture of these famous British motorcycles Pyrene Metal Finishing Processes play their important part.

BONDERIZING
Bonds Paint to Metal Surfaces

BONDERIZING
Assists the Cold Forming of Steel

PARKERIZING
Rustproofing Process

PYLUMIN
Bonds Paint to Aluminium and Aluminium Alloys

PARCO-LUBRITE
Reduces Wear on Moving (Ferrous) Parts

THE PYRENE COMPANY LTD · METAL FINISHING DIVISION · GREAT WEST ROAD · BRENTFORD, MIDDLESEX

The Dallow Lambert ME 10/9 dust collector

This new series, employing the hydrostatic cross tube element, scrubs dust laden air in either water or oil.

Of modern design, the unit attains a high separation efficiency; it is compact; bears a high air volume to cost and space ratio, and operates without either pumps or sprays.

The illustration shows model ME 10/9 designed as a complete unit to handle 1,000 c.f.m. A hand controlled valve allows for sludge removal on this model.

CHROMIUM PLATING ANODES

KINGSLAND ENGINEERING CO. LTD., 25-37 Hackney Road, London are manufacturing new tin-lead chrome plating anodes, their type C.189. The advantages claimed over antimonial lead are higher corrosion resistance, higher electrical conductivity, improved throwing power and greater mechanical strength and rigidity.

NEOPRENE PROTECTIVE COATING

A NEOPRENE coating material which can be sprayed or painted on to wood, glass, plastics, metal or concrete surfaces, to provide either protection against corrosion, or anti-skid surface qualities, is being manufactured by the Magic Chemical Company.

The material, which is said to be resistant to oils, acids and alkalis and to be unaffected by strong sunlight, can also be used for caulking leaks or for sealing. Its insulating properties are said to make it a useful repair material for electrical parts.

Magic Chemical Company, 121 Crescent Street, Brockton, Mass.

ZINC ALLOY DIE CASTING EXHIBITION

THE Zinc Alloy Die Casters Association is holding an Exhibition of zinc alloy pressure die castings at the Birmingham Exchange and Engineering Centre, Stephenson Place, in Birmingham from the 25th to 30th October, 1954.

The Exhibition is designed to bring to the attention of the public the wide variety of products made by the pressure die casting process. It will consist of over 200 different zinc alloy die castings made in the United Kingdom, including one of the smallest castings produced, weighing approximately 1/100 oz.

Examples of the wide variety of finishes obtainable on zinc alloy die castings will also be shown.

The Exhibition coincides with the International Pressure Die Casting Conference being held at Church House, London, from 25th to 28th October.

EFCO TO BUILD NEW FACTORY

MR. D. F. CAMPBELL, chairman of Electric Furnace Co. Ltd., in his recently published statement for the year ending 31st March, 1954, said that the directors had decided to build a new factory in the London area. This factory is to meet the rapidly growing requirements of the group and particularly the wholly owned subsidiary, Electro-Chemical Engineering Co. Ltd. He also stated that the new Canadian venture, EFCO-Lindberg Ltd. had made a satisfactory start.

Acheson Colloids Gredag Division.—Acheson Colloids Ltd. have established a division to handle the growing volume of business in their "Gredag" greases and compounds. This will operate from the Company headquarters at 18 Pall Mall, London, S.W.1.

Another division was established, with its own factory, in 1953, to manufacture dispersions of finely divided pigments in all media, as part of a co-ordinated plan of Acheson Industries Inc., of New York, of which Acheson Colloids Ltd. is a unit.

WATER WASH SPRAY BOOTHS *of* GREATER SIMPLICITY *and* HIGHER EFFICIENCY

There are no pumps, nozzles or filters to choke or need attention. The only moving part is the fan, which handles the clean dry air from the high efficiency wash and discharges it to the atmosphere.

We welcome enquiries for incorporating these advantages in proprietary booths. We can also offer the same advantages of clean exhaust with very little maintenance for DUSTS AND FUMES FROM POLISHING, GRINDING AND PLATING

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Fig. 2. The upper portion of the 300 gal. vessels, showing the mechanism for driving the mixing paddles

MANUFACTURE OF COLOUR PIGMENTS

A USEFUL application of automatic gas-fired boilers for industrial work has been found recently in the pigment-making field.

Coloured pigments such as are used in paint and printing ink manufacture are frequently made by depositing an organic dyestuff upon the minute crystals or particles or a carrier or base, at the moment they are formed by precipitation or double decomposition.

In the case in point 500 gallon wooden vats are used to contain one of the reacting solutions, the other solutions being poured or squirted into the hot liquid. The liquid is heated to a temperature of anything up to 98°C., and for this purpose the use of live steam is particularly suitable.

The reacting solutions, which are concentrated and therefore occupying far less bulk, are also gas-heated in separate vessels, and along with the dyestuffs are introduced into the vats, the contents of which are stirred with revolving paddles.

The rate of heating of the solutions is fast and the gas consumed quite low. The system also has the advantage of avoiding any possible complication of contamination.

Steam pressure is automatically controlled in order that the solutions may be raised to a pre-determined temperature at a carefully-controlled rate and thereafter thermostatically controlled during the precipitation. A rather delicate process has been successfully and consistently carried out without any hitch since the first use of the installation.

Fig. 1 is a view of the two 8S controlled flame gas-fired boilers linked to a common steam line for steam injection to three 500 gallon and two 40 gallon vessels. Each boiler is an independent and fully-automatic unit and may be used together or singly at will. These boilers are able to boil 300 gallons of water in one vessel in a little over 1 hour from the lighting up.

Fig. 2 shows the upper portion of the 300 gallon vessels with the mechanism

(*Continued on page* 216)

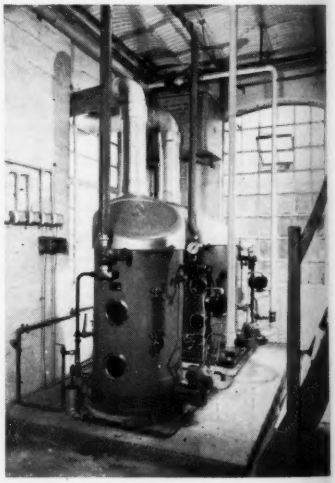
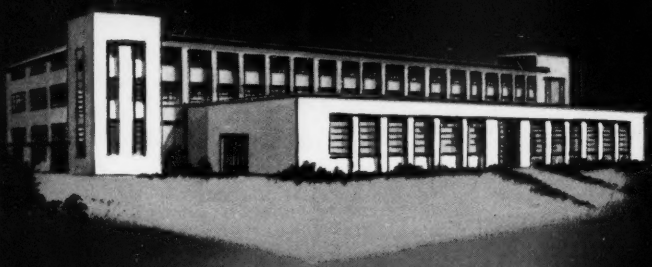


Fig. 1. View of the two controlled flame bodies linked to a common steam line

THE *Power* BEHIND



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Radiant Heat Stoving Enamels

★ STOVES BY RADIANT HEAT. LIGHT GAUGE METAL 2 MINUTES. HEAVY GAUGE METAL [illegible]

★ ALTERNATIVE MATERIAL 1 HOUR AT 250°F. OR ½ HOUR AT 275°F.

★ HIGH OPACITY. BRILLIANT GLOSS. EXCELLENT [illegible]

★ ONE COAT IS EFFECTIVE ON BARE METAL.

★ [illegible]

WRITE FOR FULL PARTICULARS TO THE SOLE MANUFACTURERS :—

Goodlass, Wall & Co., Ltd.

INDUSTRIAL DIVISION - GOODLASS ROAD - SPEKE - LIVERPOOL

ROOF STOVING GAS OVENS HALVE COSTS

The monthly bulletin on productivity, issued by the Economic Section of the Treasury, gives an account for the information and emulation of other firms, of a new roof stoving gas oven which halves costs.

HEAT wastage due to gas ovens being opened after the completion of the stoving process has been almost eliminated at the Perry Barr, Birmingham, works of Evertaut Ltd., following the construction of a stoving oven in the roof of the spraying shop and feeding it from below. Material to be stoved is now placed on a moving platform which rises beneath the oven, actually forming its "floor" during stoving. When the platform is lowered, the hot air, due to its natural tendency to rise, remains in the oven so that little heat is lost. Evertaut, who make factory and office equipment, estimate that the new layout has doubled productivity in stoving, reduced fuel consumption by half and saved valuable floor space.

Under the old system of using ovens at floor level (one such stove is still in temporary use by the firm), the complete cycle of stoving took just under two hours. Fifty-two industrial lockers in the 12 ft. by 12 ft. by 12 ft. oven represented one stoving, average throughput per day being 234.

It took fifteen minutes to fill the oven and more than thirty minutes before the temperature could be built up to 250° C.; opening of doors for loading and unloading involved a temperature drop of 70°. After approximately thirty minutes stoving at 250°, the oven had to be opened for fifteen minutes before it was cool enough to enter for unloading.

The new thermostatically controlled oven is built over a 9 ft. by 9 ft. by 9 ft. lift which has a moving platform with gates on two adjacent sides, permitting on and off loading to proceed without congestion.

Sprayed lockers are fed through the gate on the right-hand side of the platform. This gate is then closed and the platform is electrically raised, taking the work up into the oven. When the work has been stoved it is brought down on the platform to floor level and is unloaded from the front gate.

The whole operation of loading, stoving, building up temperature to 320° and unloading now takes approximately twenty-two minutes and at least twenty-two stovings a day can be completed. Allowing for the fact that the oven space is now smaller, twenty-four lockers are treated at once, making the total throughput per day 528.

In addition, gas costs have been cut from 8s. to approximately 4s. an hour, due to the fact that there is less than 10 per cent. of heat lost when the "bottom" of the oven is open.

This roof oven is thought to be the first of its kind to be built in this country.

O.C.C.A. 1955 CONFERENCE ON FILM STRUCTURE AND ADHESION

THE 1955 biennial conference of the Oil and Colour Chemists' Association will be held at Llandudno from the 7th to 11th June.

The technical sessions, under the general title "Film Structure and Adhesion," will all take place in the Grand Hotel, Llandudno, where most members will be accommodated during the conference. The papers to be given are being arranged by the Honorary research and development officer of the association, Mr. P. J. Gay, of Hangers Paints Ltd., Stoneferry Works, Hull, and anyone who is interested in presenting a paper should contact Mr. Gay as soon as possible. He would particularly like to include a paper from a scientist who is closely connected with paint manufacture. Amongst the papers that it is hoped to present will be: Mr. P. D. Wright, of British Industrial Solvents, on the effect of solvents on film structure. Dr. S. H. Bell, or a colleague, from the Paint Research Station, will give a general paper on film structure, dealing particularly with chemical and physical aspects. Mr. G. A. Day, of the Electrical Research Association, on the permeability of films to moisture. Dr. J. H. Schulman and Dr. C. S. Hocking, of the Department of Colloid Science of Cambridge University, on the induced permeability of charged particles through porous membranes, which will have implications in the permeability of paint films.

Afternoon visits to places of interest will be arranged for the ladies attending the conference, and there will be facilities for all forms of recreation.

Further information about the conference can be obtained from the general secretary, Mr. R. H. Hamblin, Oil and Colour Chemists' Association, Memorial Hall, Farringdon Street, London, E.C.4.

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CUTS YOUR POLISHING COSTS

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Why is "Supreme" Polishing Composition so good?

Because materials have been blended into the compound to increase the Melting Point and efficiency.

What has the melting point to do with polishing?

If a compo with a low melting point is applied to the hot surface of a mop, it melts almost immediately and much of the compo is thrown off the mop into the dust extractor. The high melting point of "Supreme" Compo reduces this waste and the compo clings to the mop surface, enabling the operator to polish a larger area of surface per lb. of compo used.

Why does "Supreme" Compo give a better finish in less time than other makes?

Because every ingredient incorporated in "Supreme" Compo performs a definite function to assist in providing a faster and clearer cut.

The efforts of our Research and Development department are directed towards providing the Metal Finishing Trades with products which will help you to reduce your costs.

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Book Reviews

. . . and Recent Technical Literature

ELECTRO-PLATING AND CORROSION PREVENTION

E. Molloy—George Newnes Ltd., W.C.2. 18s. net.

THE author mentions in his preface how electro-plating as such has now emerged from an art to a science and that today modern electro-deposition is an exact process requiring critical adjustments of the strength of the electrolyte, the current density and operating conditions. In the book he sets out to offer a guide to modern plating practice. Because of the corrosion resisting qualities of a variety of proprietary phosphating and metallising processes, these are also covered.

In the first part of the book the general principles of electro-deposition such as electrical connections, resistance boards, and plating shop requirements are covered. Next follow details on the pre-treatment of articles prior to plating, including methods used for pickling and dipping.

The author then continues to deal with electro-deposition details of chromium, cadmium, nickel, lead and zinc, referring to the use of instruments in works practice. He follows by considering tin-plating together with the tin-alloy plating processes such as tin-zinc, tin-nickel and speculum plating. Silver- and gold-plating are dealt with separately, followed by the specialised applications of electro-plating in the printing industry and hardware trade.

Later he deals extensively with the testing of electro-plating for colour, thickness, porosity, corrosion resistance and adhesion, whilst he includes an important chapter on the relatively new periodic reverse current electro-plating. Following this come details on the various proprietary phosphate coatings and different forms of metal finishing.

The final chapter covers metal spraying by powder, wire and molten metal. The information given will be of use not only to those engaged in electro-plating, but also to the buyers of electro-plating and those responsible for the production of cars, commercial vehicles, bicycles, hardware, etc., whose sales appeal depend upon appearance, and ultimate life upon the corrosion resisting characteristics.

Cambridge Instrument Co. Ltd.—We have received an illustrated information sheet from the Cambridge Instrument Co. Ltd., 13 Grosvenor Place, S.W.1, dealing with their corrosion voltmeter. With this instrument it is possible to ascertain the extent of corrosion in buried or immersed ferrous structures by measuring the electric potential between the structure and its environment.

ESTABLISHING A SUBSIDIARY IN CANADA

THE Board of Trade has produced a 14-page pamphlet for the guidance of those firms who may be considering setting up a subsidiary organisation in Canada.

It touches on most of the more important factors which have to be takeng into account and includes an appendix listing useful contacts in the Provinces of Canada.

The pamphlet will be sent free on request. Applications should be addressed to the Board of Trade, Commercial Relations and Exports Department, Room 4170, Horse Guards Avenue, London, S.W.1. (Telephone: TRAfalgar 8855, Ext. 2625.)

Victum Sleeving. — A recently published 14-page illustrated booklet of Lacrinoid Products Ltd., Gidea Park, Essex, gives information on the polyvinyl-chloride sleeving, vietum. With the application of heat this material contracts between 30 and 40 per cent. in dia., making a firm, permanent covering for rods, tubes and bars. This plastic sleeving is resistant to oils, spirits, acids and alkalis and its electrical insulation is good. Numerous examples of its application are given together with a conversion table.

(*Continued from page* 212)

for driving the mixing paddles. The insulated copper steam line is taken to the bottom of the container and is turned to give a swirling injection. Apart from the initial bubble when the steam valve is opened there is no escape of steam through this depth of water.

The installation was arranged and carried out by the North Thames Gas Board at the factory of Dane and Co. Ltd., Sugar House Lane, Stratford, E.15.

READER SERVICE SECTION

Items in the following list of manufacturers' literature are available as a personal service to readers of INDUSTRIAL FINISHING *by using the reply card below.*

In addition, the editorial staff of INDUSTRIAL FINISHING *are always available as an advisory service on questions affecting finishing.*

Paddle Blade Centrifugal Fans. A 4-page, illustrated brochure gives details of a series of paddle blade centrifugal fans, the discharge direction and rotation of which can be easily changed on site; illustrated explanations are given of how the changes are made. Exploded views of different driving arrangements are shown. Mathews and Yates Ltd., Cyclone Works, Swinton, Manchester (120)

Shrinkable Plastic Sleeving. A 14-page, illustrated booklet deals with a polyvinylchloride material resistant to oils, acids and alkalis, of good electrical insulation, which can be shrunk on to rods, bars and tubes to form a firm, permanent covering. Sleeving diameter shrinks from 30 to 40 per cent. on heating. Examples of applications are given together with a conversion table. Lacrinoid Products Ltd., Gidea Park, Essex. (121)

Metal Adhesive Processes. An illustrated paper by Mr. F. H. Parker, Development Engineer, The Bristol Aeroplane Co. Ltd., describes the equipment processes and experiences of his company in metal bonding. Aero Research Ltd., Duxford, Cambridge. (122)

Plating Barrels. Illustrated brochure supplies information on a new range of plating barrels of 1 pint, 4 pints, and 2 to 3 gal. article capacity. The barrels are rotatable during discharge, have a built-in motor drive and adjustable plating angle. Wm. Canning and Co. Ltd., Birmingham 18. (123)

Long-Life Silicon Carbide Furnace Element. Details of a new one-piece silicone carbide tube, in which the central hot zone is in the form of a spiral, are given in an illustrated pamphlet. The element works over a temperature range

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233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250				

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Name **Position**

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READER SERVICE

of 800° to 1,575° C. and is claimed to have an unusually slow rate of ageing. The elements can be supplied with shrunk-on metal terminal caps. Morgan Crucible Co. Ltd., Battersea Church Road, London, S.W.11 (124)

Mica in Anti-Corrosive Paints. Technical notes explain the functions of mica in the following anti-corrosive paints: red iron oxide; zinc chromat and red iron oxide; red lead; zinc dust; lead cyanamide; calcium plumbate and aluminium powder. Mica is claimed to have three main purposes in such uses; to improve the anti-corrosive properties of the cheaper pigments; to reduce costs without lessening the effectiveness of more expensive pigments and to ensure good storage stability. Micafine Ltd., Raynes Way, Derby. (125)

Pneumatic Sander. Information is given in an illustrated brochure about a single-pad pneumatic sander with straight line motion for all types of finishing wet or dry. It gives up to 3,000 oscillations per minute, works at an air pressure of 60 to 80 lb. per sq. in. and has a pad area of 24 sq. in. Herbert Grange and Co. Ltd., Norgren Works, Shipston-on-Stour, Warwickshire. (126)

Corrosion Voltmeter. Pamphlet illustrates and describes an outfit designed to measure corrosion of buried or immersed ferrous pipes or structures. The instrument measures the electric potential between the structure and its environment. From this information an accurate estimate of the location and extent of corrosion can be formed. Cambridge Instrument Co. Ltd., 13 Grosvenor Place, London, S.W.1. (127)

Dehumidifier. Brochure depicts and describes a dehumidifier designed to combat conditions of high humidity and attendant troubles by extracting moisture from the atmosphere without loss of temperature. The unit will operate in unventilated spaces of up to 10,000 cu. ft.; temperature from 55° to 90° F. Maximum extraction rate is 3·6 gal. in 24 hours. Dimensions 28½ in. long by 29 in. high by 15 in. wide. F. H. Biddle Ltd., Vectair House, Clerkenwell Close, London, E.C.1. (128)

Instruments Useful in Finishing. A 32-page catalogue of an electrical instrument manufacturer contains, amongst other items of interest to finishers, information on a colour comparator, glossmeter, paint abrasion testing machine and paint thickness meter. Illustrations and descriptions of the instruments are given. Pamphlets explain the services offered by the firm. Nash and Thompson Ltd., Oakcroft Road, Tolworth, Surrey. (129)

Circle items you desire on reverse side, cut out and post this card.

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The new Sheffield premises of the W. Canning Organisation at 1 South Parade, Shalesmoor, in which extensive structural alterations have been made to accommodate large stocks of equipment and materials to meet increasing demands of the Northern plating trade. The building includes a retail shop and showroom and an analytical laboratory will be available in due course to analyse solutions for Northern plating houses. An improved transport delivery service, operating from the new premises, will cover Sheffield and West Riding areas

TECHNICAL MEETINGS IN PARIS

THE IIIe Salon de la Chimie et des Matières Plastiques, which will be held from 3rd to 12th December at the Porte de Versailles, Paris, will be the meeting place for a number of international conventions—the "Technical Meetings in Paris."

The most recent developments in the production of basic chemical raw materials, their processes of manufacture and methods of use will be the general subject of the series of lectures and discussions.

Amongst others the following meetings are likely to be of interest: New Vacuum Techniques, 3rd December; Antifouling Paints, 8th December; Recent Developments in Plastics, Corrosion, 11th December.

Chemists, technologists, engineers and industrialists who wish to attend the "Technical Meetings in Paris" can obtain a detailed programme on application to the Secrétariat du Comité d'organisation, 28 rue Saint-Dominique, Paris 7.

O.C.C.A., London Section.—A paper on "The Manufacture of Industrial Nitrocellulose," by W. A. Caldwell and J. Creasy, will be presented at the London Section of the Oil and Colour Chemists Association at their meeting on the 20th October, which takes place in the Royal Society of Tropical Medicine and Hygiene, 26 Portland Place, W.1, at 7 p.m.

Pera Mobile Demonstration Unit.—The Production Engineering Research Association mobile demonstration unit began its first tour of the country at the beginning of September to visit engineering firms by appointment. After its Scottish tour it will go to Leeds, calling on firms in the Newcastle area on the way. The unit consists of a vehicle and trailer containing a small cinema and lecture theatre to seat twenty-four, a demonstration and an exhibition room.

"Aries" Painted with International Paints.—The diesel lifeboat "Aries," which completed the double crossing of the Atlantic recently, was, we are informed, painted with International Paints.

NAMES IN THE NEWS

D. McDONALD

MR. DONALD McDONALD, chairman of the executive committee of the board of Johnson, Matthey and Co. Ltd., since 1950, retired on 31st August after forty-four years' service with the company.

Mr. McDonald joined the company direct from University College, London, in 1910 as a junior chemist and as soon as 1920 was appointed manager of the refineries at Hatton Garden. He assisted in the design and construction of the new electrolytic silver refinery, and later turned his attention to the development of the chlorine process of gold refining and the installation of the necessary equipment. In 1939 he was appointed to the Board as director of the Bullion Department and of Research, adding to his duties in ensuing years the directorship of Labour Management and Mechanical Production.

Mr. McDonald has published an account of the life of the founder of the company, Percival Norton Johnson, and recently been engaged upon the compilation of a detailed history of platinum from its discovery until the 1880s.

At a brief ceremony in the recently completed Hatton Garden office block—in the construction of which he was closely associated—Mr. McDonald was presented with a cheque and a bound book of signatures of his colleagues and friends throughout the company.

Below: The portrait in oils of Mr. W. E. Wright by S. J. Iredale, referred to in last month's editorial. The portrait was presented to Mr. Wright, a director of the Pyrene Co. Ltd., to commemorate twenty-five years service with the company

R. J. LANT

BLUNDELL, SPENCE AND CO. LTD., have announced the appointment of Mr. Richard John Lant as manager of the newly-formed South-Western Sales Area, with headquarters at their new depot at Feeder Road, Bristol.

Mr. Lant joined Blundell's after three years as senior architectural assistant with the Hull City architect; was an associate member of the R.I.B.A., and holds the Leeds Diploma of Architecture.

He co-operated with a London architect in the design of Blundell's new Bristol depot, and is responsible for the selection of colour schemes.

During the war Mr. Lant was an interpreter with the 6th Airborne Division.

H. J. Finden.—Mr. H. J. Finden, M.I.E.E., chief engineer of the Electronic Instruments Laboratory of The Plessey Co. Ltd., having attended the official opening last month of the new laboratory of the United States Bureau of Standards at Boulder, Colorado, is spending several weeks in the United States, making a general study of computing problems and electronic controls.

H. Laithwaite.—Mr. H. Laithwaite, M.Sc.Tech., A.R.I.C., Assoc.M.Inst.Gas E., Member of Council of Institute of Vitreous Enamellers, has been appointed managing director of Metal Porcelains Ltd., an associate of the Incandescent Group of companies. Mr. Laithwaite has been with the Radiation Group since 1935, where he had charge of vitreous enamel manufacture, and was responsible for development and liaison work on vitreous enamels and ceramics.

CANNING VISIT

RECENTLY fifty delegates from the International Symposium on "Analytical Chemistry" held in Birmingham formed by the Midlands Society for Analytical Chemistry visited Wm. Canning & Co.'s engineering works. They were entertained to lunch by the directors and conducted through the laboratories and works by members of the executive staff.

The illustration shows the delegates looking at the latest of Canning hydraulic-electric automatic plating plant an example of which was being constructed at the time for the visit.

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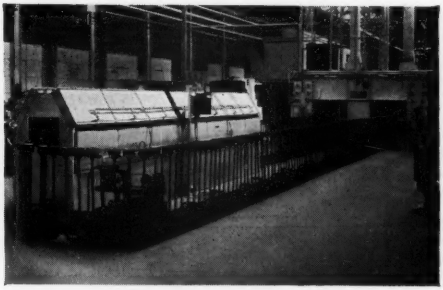

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Delegates looking at a Canning hydraulic electric automatic plating plant in the course of construction

T. E. Hughes.—Mr. T. E. Hughes, who is well known for his work in connection with the development of the aluminising process, has joined the Technical Advisory Staff of Mander Bros. Ltd. He will be available to give expert advice on this, production flow methods and paint application.

Wm. Harland and Son.—The address of the Glasgow branch of Wm. Harland and Son Ltd., the paint manufacturers, has recently been changed to: 146 West Regent Street, Glasgow, C.2. The premises are much larger and include a showroom for the convenience of Scottish customers.

They have also opened a new branch in Manchester at: 28/32 Dean Street, Port Street, Manchester 1.

Paint Federation.—The Federation annual dinner and dance will be held at Grosvenor House, Park Lane, London, on Wednesday, 24th November. Mr. Tom Williamson, C.B.E., J.P., will be chief guest. Tickets cost £2 10s. each.

O.C.C.A. London Section "Ladies' Night."—The 1954 Dinner-Dance of the London Section of the Oil and Colour Chemists' Association will be held at the Monico Restaurant, Piccadilly, London, W.1, on the 26th November. The price of single tickets will be one and a half guineas each. Further details may be obtained from the General Secretary, R. H. Hamblin, Oil and Colour Chemists' Association, Memorial Hall, Farringdon Street, E.C.4.

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AN INVITATION

To individual readers: The Personal Reader Service Section facing page 216 is for your use and convenience, do you make use of it?
To firms interested in finishing shop supplies: You are invited to send in material suitable for inclusion in the above feature, there is no charge for this service and it is operated in our mutual interest.

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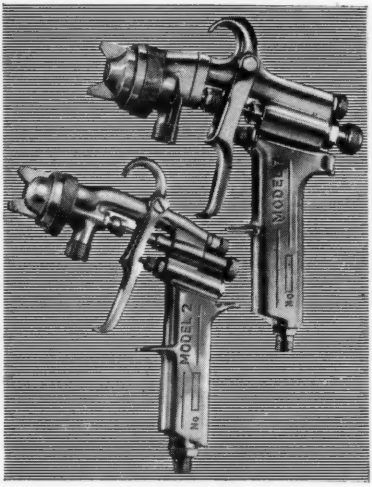

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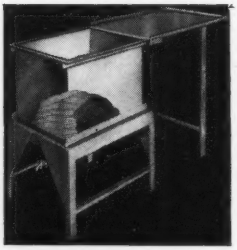

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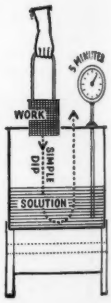

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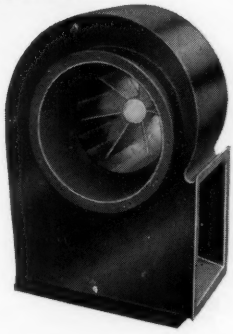

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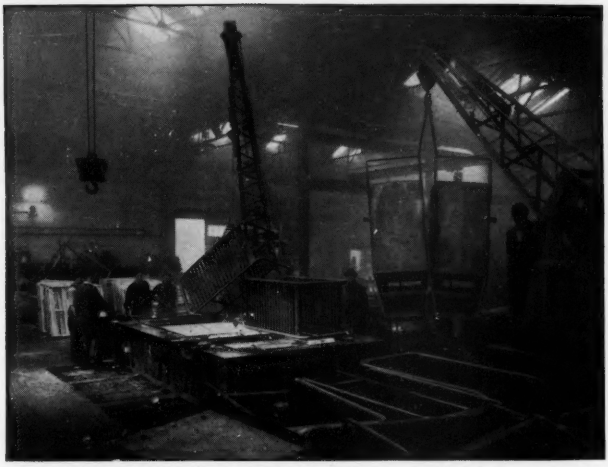

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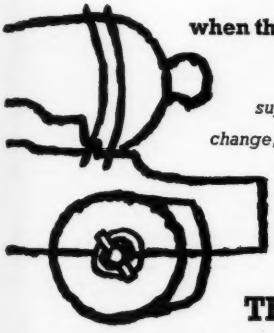

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Aerograph Co. Ltd., The 171
Aerostyle Ltd. 166
Air Industrial Developments Ltd. 221
Ashton and Moore (Metal Colourers) Ltd. 220
Atlas Diesel Co. Ltd. ... ... —
Atlas Plating Works Ltd. ... ... —
Ault and Wiborg Group ... *Cover* iii
Ballard, F. J. & Co. Ltd. 174
Bennett (Hyde) and Co. Ltd. ... —
B.H. Chemicals Ltd. 156
Bratt Colbran Ltd. ... ... —
British Electrical Development Association 158
British Oxygen Co. Ltd. 155
British Paints Ltd. ... ... *Cover* iv
British Vapour Blast Ltd. ... ... —
Bullows, A. and Sons Ltd. ... —
Canning, W. and Co. Ltd. 167
Carrier Engineering Co. Ltd. ... —
Carr's Paints Ltd. 201
Cellon Ltd. ... ... —
Cooper and Co. (B'ham) Ltd. ... 224
Cox Bros. and Co. (Derby) Ltd. ... 165
C. & P. Developments Ltd. ... 223
Cruickshank, R. Ltd. 215
Curran, E. Engineering Ltd. ... —
Cyclo Gear Co. Ltd. ... ... —
Dawson Bros. Ltd. 170
De La Rue, Thomas and Co. Ltd. 112-3
Detel Products Ltd. ... ... —
Docker Bros. 160
Drummond Patents (Holdings) Ltd. 211
Electric Construction Co. Ltd., The —
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Fishburn Printing Ink Co. Ltd. ... —
Fletcher, Miller Ltd. ... ... —
Gas Council, The 162
Giegy Co. Ltd. 169
General Electric Co. Ltd., The ... —
General and Industrial Paints Ltd. —
Gittings and Hills Ltd. ... ... —
Goldsworthy, Thomas and Sons Ltd. ... ... —
Goodlass, Wall and Co. Ltd. ... 213
Gosheron, John and Co. Ltd. ... 222
Grauer and Weil Ltd. 228
Griffiths, A. E. (Smethwick) Ltd. ... 172
Harefield Industrial Paints Ltd. ... —
Hall, John and Sons (Bristol and London) Ltd. 197
Hawley, John and Co. (Walsall) Ltd. 227
Heat and Air Systems Ltd. ... —
Hockley Chemical Co. Ltd., The 164
Holden, Arthur and Sons Ltd. ... —
Honeywell-Brown Ltd. ... ... —
Industrial Colloids Ltd. 221
Industrial Fan and Heater Co. Ltd. 223
International Paints Ltd. 163
Imperial Chemical Industries Ltd. (Paints Division) ... ... —
Incandescent Heat Co. Ltd. ... —
Ingham, Clark, Robert and Co. ... 168
Ionic Plating Co. Ltd. ... ... —
Jenolite Ltd. 161
Jenson and Nicholson Ltd. ... —
Kaylee Transfers Ltd. ... *Cover* i
Kearsley, Robert and Co. ... ... —
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Nu-Swift Ltd.	221
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Norgren, C. A. Ltd.	—
Oakey, John	—
Parkinson and Cowan (Gas Meters) Ltd.	219
Parsons, Thomas and Sons Ltd. ...	225
Pinchin, Johnson and Associates Ltd.	153
Postans Ltd.	—
Preston, John and Co. Ltd. ...	—
Prodorite Ltd.	*Cover* ii
Pyrene Co. Ltd., The	209
Radiant Heating Ltd.	—
Radiant Metal Finishing Co. Ltd. ...	—
Round, B. J. Ltd.	154
Shell Chemicals Ltd.	159
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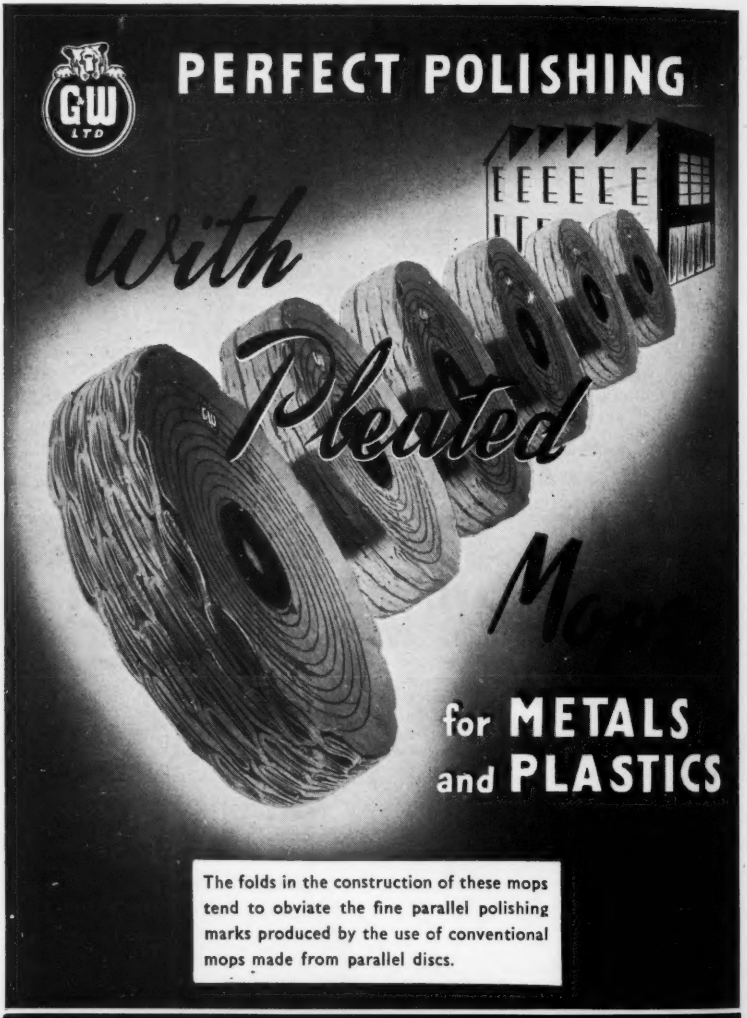
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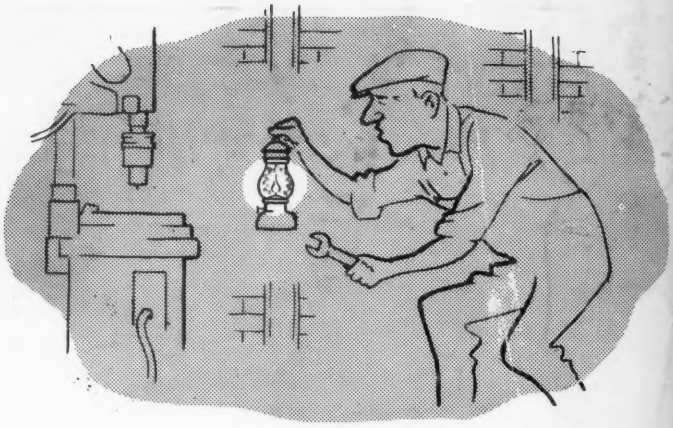

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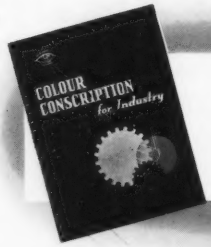

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